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Rocky Flats Environmental Technology Site
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-8244

CORRES. CONTROL LTR. NO.

-ADM-00011-KH

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ARTHEL, J. M.	X	
ENGEL, P. R.		
ENSON, C. A.		
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ITZ, R. C.		
UINN, L. A.		
IERREE, C. C.		
ACANALLY, J. L.		
ARKER, A. M.		
OWER, A. P.		
VAGNER, M. J.		
EILE, H. J.		
ayton, C.	X	X
etlock, G.	X	X
esson, A.	X	
CORRES.CONTROL	X	X
RMRS CC	X	X
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CLASSIFICATION:

UCNI		
UNCLASSIFIED	X	X
CONFIDENTIAL		
SECRET		

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IN REPLY TO RFP CC NO.:

ACTION ITEM STATUS:
__ OPEN __ CLOSED
__ PARTIAL

LTR APPROVALS:

ORIG & TYPIST INITIALS:

RF-46469(Rev.9/92)

1/73

January 18, 1996

96-RM-ADM-00011-KH

D.L. Whaley
Kaiser-Hill
Planning & Integration
Building T130C
Rocky Flats Environmental Technology Site

TRANSMITTAL OF DRAFT OF INITIAL SECTIONS OF INTEGRATED WATER MANAGEMENT STRATEGY - JMB-011-96

Action: Review and comment on attached draft

Attached for your review is a draft of the initial sections of the Integrated Water Management Strategy covering past and projected water uses at the Rocky Flats Environmental Technology Site and a description of the alternatives proposed for evaluation in the strategy.

Kaiser-Hill Company, L. L. C. has requested that this document be submitted to the Department of Energy/Rocky Flats Field Office so that consensus is reached on the alternatives to be evaluated in light of the continuing discussions on cleanup standards.

Please return comments to John Hopkins of my staff at T893B, or call him at extension 4974.

for JMB

James M. Barthel
Manager, Strategic & Integrated Planning
Rocky Mountain Remediation Services, L.L.C.

JMB:vkl

Attachment:
As Stated

11.060.F

cc:
C. Dayton
G. Setlock

ADMIN RECORD

SW-A-004256

1.0 INTRODUCTION

The purpose of the Integrated Water Management Strategy (IWMS) is to integrate all on-site water management activities in the context of the draft Rocky Flats Environmental Technology Site (RFETS) conceptual Vision and the Accelerated Site Action Project (ASAP). Existing water and wastewater management planning documents will form the basis for the IWMS and include: *Sitewide Wastewater Treatment Strategy*, draft *Strategic Plan for the Management and Remediation of Groundwater at the Rocky Flats Environmental Technology Site*, draft *Pond Operations Plan*, and the *Pond Operations Plan Technical Appendix* (RMRS, 1995a; RMRS, 1995b; RMRS, 1995c; RMRS, 1995c).

The objectives of the IWMS include the following:

- Protect human health and the environment;
- Ensure efficient operation of on-site water management;
- Create a coordinated, comprehensive, and prioritized water management process;
- Reduce operating costs for water management at RFETS; and
- Identify and pursue strategic regulatory and operational issues that affect costs, human health, and the environment.

The IWMS includes an evaluation of the overall water usage for RFETS for both current and projected operations, i.e., a water balance on raw water entering the Site, raw and domestic water used, and treated water discharged. The evaluation of water usage at the Site along with the integration of various elements of water management in this one strategy document ensures that assumptions, recommendations, and conclusions noted in the aforementioned plans and strategies have been integrated site-wide.

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The IWMS also provides an evaluation of water management alternatives designed to meet the objectives of the Site's various water management strategies and plans. The most significant variable among alternatives is regulatory compliance, namely, standards/goals regulating water management. The alternatives developed in the IWMS address a range of potential regulatory enforcement scenarios. Ultimately, the alternative considered the best by all parties will be implemented as site-wide water management practices.

1.1 APPROACH

Detailed reviews of the *Sitewide Wastewater Treatment Strategy*, draft *Strategic Plan for the Management and Remediation of Groundwater at the Rocky Flats Environmental Technology Site*, and the *Pond Operations Plan* were conducted along with an evaluation of current and future water usage at the Site. Water management alternatives were developed with consideration given to various regulatory enforcement scenarios potentially applicable to overall water management at the Site.

1.2 DOCUMENT ORGANIZATION

The IWMS provides a summary of current water management systems and practice for the Site (Section 2) followed by a summary of projected water management practices and needs (Section 3). Each summary is prefaced with a discussion on regulatory considerations. Following the summaries of current and future water management practices and needs is a section on water management alternatives evaluation (Section 4). This section notes assumptions made in conjunction with alternative development, including assumptions on various regulatory enforcement scenarios. Finally, Section 5 provides recommendations on future water management at the Site.

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2.0 SUMMARY OF CURRENT WATER MANAGEMENT SYSTEMS AND PRACTICE

The purpose of this section is to provide general information on the current water management practices at the Site. The summary focuses on the current regulatory environment, current Site water management system components, current Site water balance, recently considered water recycle options, and the current net discharge of water off the Site.

2.1 REGULATORY CONSIDERATIONS FOR CURRENT SITE OPERATIONS

In general, there are three major regulatory acts governing current water management systems and practice at the Site: Clean Water Act (CWA), Resource Conservation and Recovery Act (RCRA), and the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). Of the requirements identified in these acts, the most significant are the rules and regulations of the CWA and the related state rules authorized by the Colorado Water Quality Control Act. Two key elements of CWA compliance, the National Pollutant Discharge Elimination System (NPDES) permit for the Site and stream standards, are discussed below.

2.1.1 National Pollutant Discharge Elimination System Permit

Because the State of Colorado lacks authority over federal facilities, the Environmental Protection Agency (EPA) writes the Rocky Flats NPDES permit, and the state approves it. The current Site NPDES permit, effective in 1984, governs discharges from the Wastewater Treatment Plant (WWTP) and surface water Ponds A-3, A-4, B-5, and C-2. The Site is currently operating under an administrative extension of the permit, which expired in 1989.

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2.1.2 Stream Standards

The State of Colorado establishes water quality standards, subject to EPA approval, through a public process in accordance with procedures of the Water Quality Control Commission (WQCC). Public hearings held by the WQCC in 1989 established site-specific stream standards for radionuclides at Rocky Flats. The DOE considers these stream standards to be water quality goals rather than enforceable standards.

The site-specific stream standards, which were adopted in 1990, are not incorporated into the current NPDES permit because of on-going negotiations between stakeholders on the stream standards to be enforced for future Site activities. There has been no enforcement action to date to test the legal basis of the standards. The stream standard for plutonium of 0.05 pCi/liter poses the most significant constraint on the discharge of water from the Site. The plutonium standard has been viewed by the state as an enforceable standard against which requests to release surface water are measured. Under current normal operations at the A-, B-, and C-series ponds, the DOE waits for the State's concurrence before discharging water from the Site. DOE discharges without concurrence only under clearly defined emergency conditions.

The current use classification of Walnut Creek as a drinking water supply requires that water recovered by the Operable Unit (OU) 4 interceptor trench system (ITS) be treated for nitrate removal prior to discharge. Reclassification of the receiving stream to remove the water supply use would result in a different nitrate limitation, and could eliminate the need for nitrate removal. In addition, uranium concentrations in the ITS water exceed the existing site-specific stream standard of 10 pCi/liter (Walnut Creek drainage). Natural background concentrations of uranium are also above the standard.

2.2 GENERAL SYSTEM DESCRIPTION/OVERVIEW

There are four major components of the overall management of water at the Site: (1) raw water purchase and distribution; (2) domestic and process water use, treatment,

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and discharge; (3) environmental restoration water collection, treatment, and discharge; and (4) surface water collection, treatment, and discharge (includes the A-, B-, and C-series ponds). Each of these components is affected by current Site operations, and, as discussed in Section 3, will change with future operations at the Site. Figures 2-1, 2-2, and 2-3 provide general representations of water management practices at the Site for raw, domestic, process, surface, and environmental restoration water.

As shown in Figure 2-1, the Site purchases raw water from the Denver Water Board (DWB). Raw water has historically been distributed to the Site's Water Treatment Plant as well as to some cooling towers and the Steam Plant. Approximately 70 percent of raw water is directed to the Water Treatment Plant for treatment. In recent years, 100 percent of the raw water has been directed to the Water Treatment Plant (per interview with Water Treatment Plant Operations Manager). After treatment, the water is distributed to Site facilities for domestic and process uses. Ultimately, all water brought onto the Site as raw water leaves the Site through either evaporation, infiltration to groundwater and subsequent discharges to surface water, direct discharges to surface water (via mechanisms such as runoff of irrigation), human consumption, waste treatment process consumption, or treated water discharge. Figure 2-1 is not intended to provide all Site raw, domestic, and process water uses; rather, it is intended to provide a general representation of raw, domestic, and process water distribution at the Site. Details on the use and treatment of raw, domestic, and process water are included in Sections 2.2.1 and 2.2.2.

Figure 2-2 is a general representation of surface water drainage at the Site. There are three drainages that collect potentially contaminated water from the industrial area of the Site: (1) North Walnut Creek, (2) South Walnut Creek, and (3) Woman Creek via the South Interceptor Ditch. North and South Walnut Creeks join to form Walnut Creek, which drains offsite. The most evident components of surface water management are the A-, B-, and C-Series detention ponds, which are located in the

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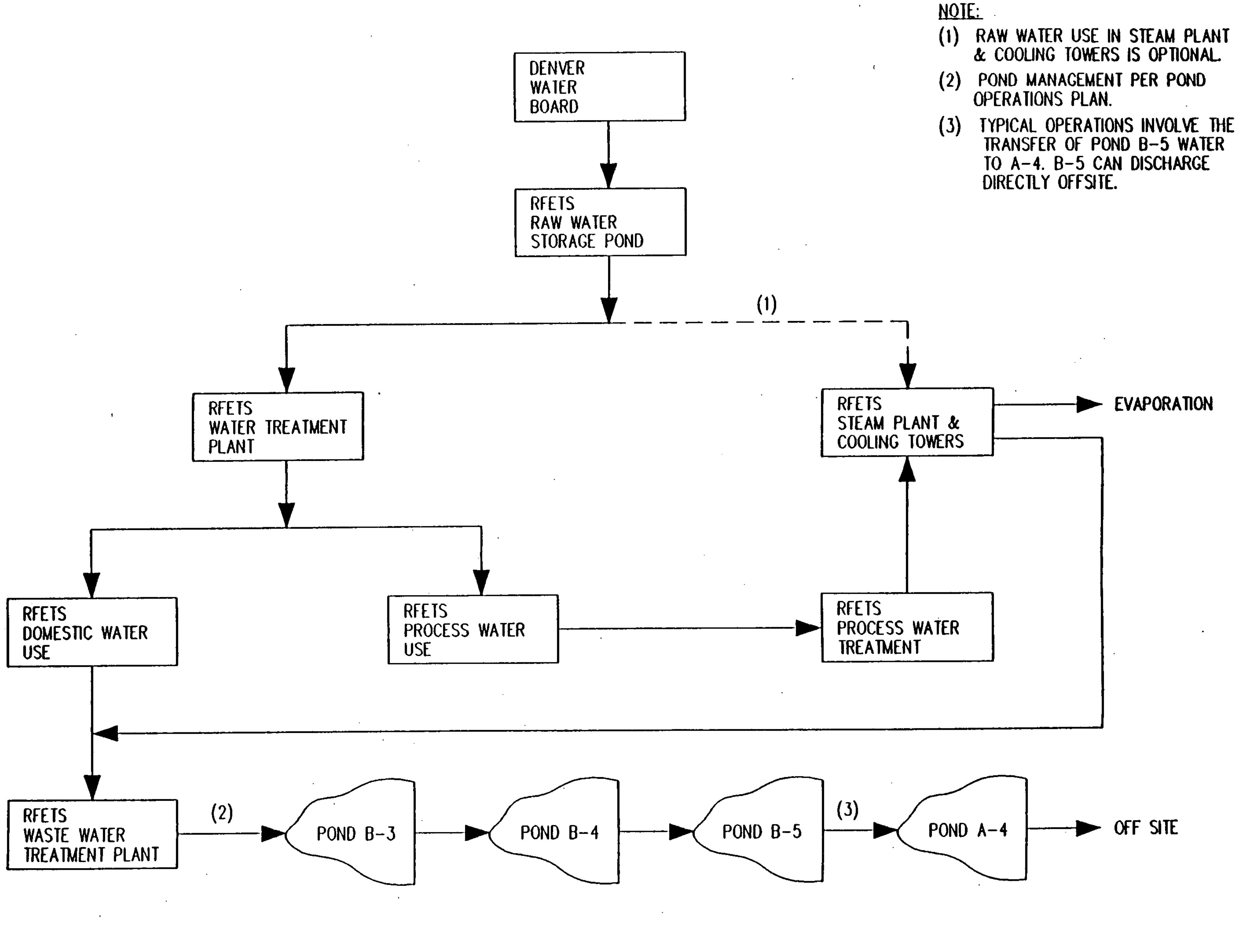

Figure 2.1 Raw, Domestic, and Process Water General Distribution

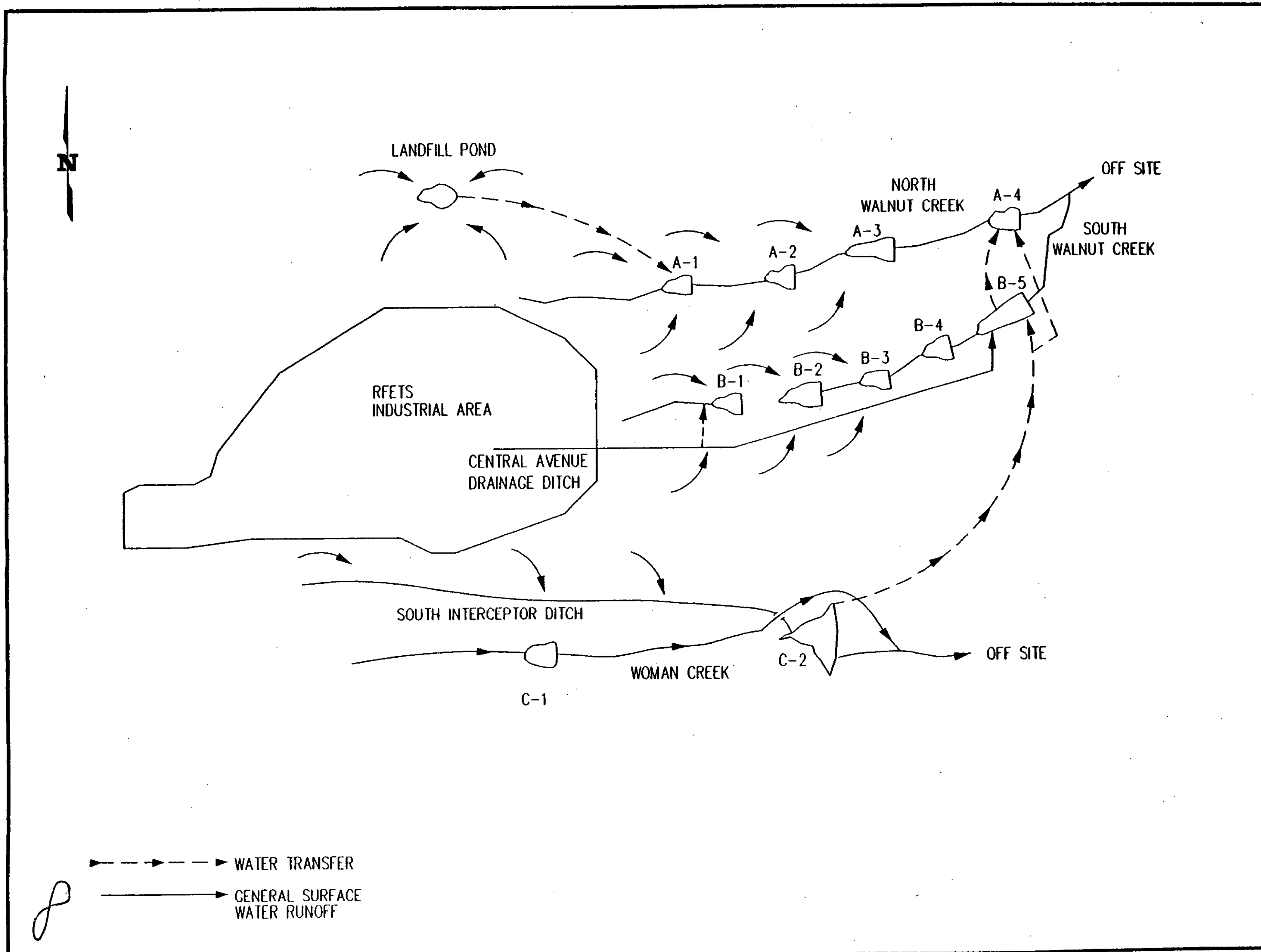

Figure 2-2 General Surface Water Runoff at the Site

North Walnut Creek, South Walnut Creek, and Woman Creek drainage basins, respectively. Details on the current management practices for these drainage basins are provided in Section 2.2.4.

Figure 2-3 provides general representations of three primary environmental restoration water collection/treatment systems currently in place at the Site. These three systems include the ITS, a landfill leachate passive collection and treatment system (expected to be in place and operational in June 1996), and a groundwater/surface water collection and treatment system supporting environmental restoration activities for OUs 1 and 2. Details on current management practices for these systems are included in Section 2.2.5.

The four aforementioned components of water management at the Site are summarized in the following sections.

2.2.1 Raw Water Purchase and Distribution

Raw water is purchased from the DWB and brought onto the Site from two feeder lines. Water brought onsite accumulates in the Raw Water Storage Pond for distribution either to the Water Treatment Plant, cooling towers, or the Steam Plant supporting Site operations.

Raw water directed to the Water Treatment Plant, Building 124, is treated prior to distribution for use as domestic water, process water, and/or water supporting Site restoration acitivities. The plant is designed to treat one million gallons per day (MGD). Treatment comprises conventional municipal water treatment operations, including a microstrainer for algae removal in the summer months; conventional alum and polymer addition for flocculation and clarification; lime and caustic soda addition for pH control; chlorine and polymer addition prior to sand filtration; and final chlorination in the clearwell. A detailed discussion of treated water is provided in Section 2.2.2.

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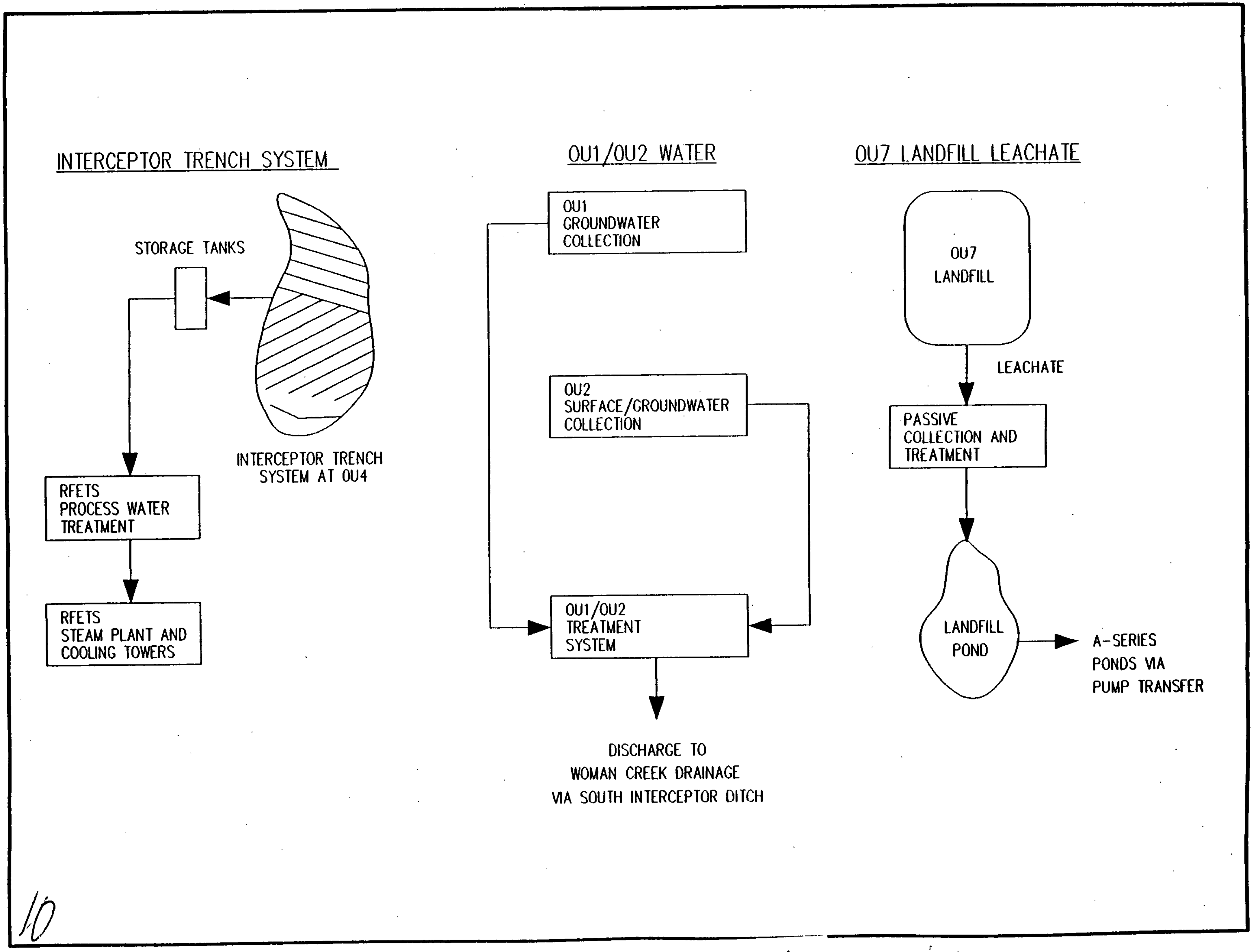

... for Environmental Restoration.

Raw water has also been supplied directly to the Site cooling towers and Steam Plant, Building 443. The raw water used by the Site cooling towers is treated locally with chemicals to minimize algae production and scaling of the heat transfer surfaces. Raw water distributed to the Steam Plant is supplemented with distillate from the Site process water treatment evaporator in Building 374. As with the raw water supplied to the cooling towers, raw water supplied to the Steam Plant is treated locally with chemicals.

Two points should be noted in relation to the above information on the use of raw water at the Site: (1) the supplemental feed of distillate from Building 374 to the Steam Plant will be discontinued upon closure of Building 374, and (2) in recent years, both the cooling towers and Steam Plant have been using domestic water in lieu of raw water, due to mechanical constraints at each facility (per conversation with Water Treatment Plant Operations Manager). The loss of distillate from Building 374 will require the use of additional domestic or raw water at the steam plant, which translates to an increase in the demand of water from the DWB. The use of domestic water in lieu of raw water at the cooling towers and Steam Plant does not impact the overall water demand by the Site; however it does impact the demands on water treatment at the Water Treatment Plant.

2.2.2 Domestic and Process Water Use, Treatment, and Discharge

Water treated at the Water Treatment Plant, Building 124, has many uses at the Site, including fire protection, drinking water, sanitary water, irrigation, laundry, construction and maintenance, cooling towers, steam generation, and Site restoration. Water strictly reserved for fire protection is maintained in a 500,000 gallon tank. This water is distributed sitewide as needed through a dedicated fire protection system.

Drinking water and water used for sanitary requirements are supplied to most inhabited buildings at the Site. In general, use is directly proportional to the staffing levels at the site. The *Treated Sewage/Process Wastewater Recycle Study, Rocky*

Flats Plant Site (EG&G, 1991), Tasks 11 and 13 of the Zero-Offsite Water-Discharge Study estimated human usage of the domestic water supply as noted below. The numbers total 27 gallons per day per person; however, it is reasonable to assume that individual water use may range from 20 to 30 gallons per day. (to be revised)

Shower use per person	14 gallons/shower	250 days/year
Sanitary use per person	2 flushes/day (4 gallons/flush)	250 days/year
Drinking water, Handwashing	2 gallons/day	250 days/year
Food processing	3 gallons/day/employee (2/3 of employees use cafeteria)	250 days/year

The laundry uses domestic water for its operations. Wastewater from laundry operations was previously sent to Building 374; however, due to a change in laundering practices, wastewater from the laundry was directed to the WWTP beginning in January 1996.

Domestic water is used seasonally for lawn irrigation in the 800 Complex (Buildings 850, 865, and 886) and Buildings 130, 131 and 060.

Domestic water is currently being used to support construction and maintenance projects at the Site. Water is obtained from fire hydrants throughout the site as well as from a tap located at Building 124. The current construction and maintenance project that is using water is the clay liner construction for the Site's new Sanitary Landfill.

Water used for site restoration is ongoing. Water use includes flushing of tankage and process lines. This use cannot be quantified since each use is unique but will probably be limited to less than 100,000 gallons per month (RMRS,1995a).

Most cooling towers on the site can perform effectively with either raw or domestic water. Raw water is used by cooling towers (CTs) at Buildings 371/374, the 400 complex, CT 709-711, CT RW 881 CT-3,4, and CT 712,713,779. Domestic water is used in CT 560-563, CT 771E, 771W, 774, the 800 complex, and the 900 area. Domestic water is also used by air washers in the 800 complex. Domestic water is typically not utilized by Building 443 for steam production. The exception to the rule is when the demineralizer is out of service for maintenance.

Sanitary wastewater generated at the Site is directed to the WWTP for conventional wastewater treatment prior to discharge offsite via the A- and B-Series ponds. Sanitary wastewater is primarily limited to water used at the Site for domestic purposes, although approximately ten percent of the influent to the WWTP is non-domestic, non-process waste. These sources are tracked by the Internal Waste Streams Program.

Process wastewater generated from building operations is directed to Building 374 for treatment. Typical process wastewater is contaminated with radionuclides and amounts to approximately 1.5 million gallons annually. Radionuclide treatment is effected through a combination of chemical precipitation and clarification and/or evaporation, with the radionuclides remaining in the sludge and concentrated brine. Treated effluent from Building 374, known as product water, is used at Site cooling towers and the Site Steam Plant. Ultimately, product water is lost through evaporation at the cooling towers and/or Steam Plant or it is directed to the WWTP as blowdown water. By using the product water as makeup in lieu of raw or domestic water, the effluent from Building 374 qualifies for the commercial reuse exclusion under RCRA.

2.2.3 Environmental Restoration Water Collection, Treatment, and Discharge

There are currently four areas of the Site undergoing contaminated water recovery and treatment for the purpose of environmental restoration: (1) OU1 - VOC-contaminated

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groundwater; (2) OU2 - radionuclide- and metal-contaminated groundwater and VOC-contaminated groundwater (note that groundwater is collected at OU2 at surface seeps); (3) OU4 - nitrate- and uranium-contaminated groundwater; and (4) OU7 - landfill leachate. Water recovered with interceptor trenches, wells, surface weirs, etc. from areas within OUs 1 and 2 is currently treated in a combined OU1/OU2 treatment facility at Building 891. Groundwater at OU4 is currently recovered with an interceptor trench system, stored in tanks, and periodically transferred to Building 374 for treatment. Landfill leachate from the OU7 Landfill is currently directed to the Landfill Pond, but will soon pass through a passive treatment system prior to discharge to the pond. Summaries of the current operations of the OU1, OU2, OU4, and OU7 systems are provided in the following sections. OU1 and OU2 are discussed in one section as the two systems have recently been combined.

Operable Unit 1/Operable Unit 2 Treatment System

The combined OU1/OU2 treatment system, referred to as the Sitewide Treatment Facility (STF), is expected to support nearly all environmental restoration water treatment needs, including groundwater and decontamination water. The STF system is configured to provide water treatment for radionuclide and metals removal as well as organic contaminant destruction. The primary unit operations comprising the individual systems are UV/peroxide oxidation, carbon adsorption, and ion exchange for OU1, and precipitation and microfiltration for OU2.

The STF operates by treating collected water from environmental restoration activities in batches. The system has a large storage capacity (40,000 gallons) for influent water. Characterization of the influent water determines the need for organic contaminant destruction (OU1 treatment system) or radionuclides/metals removal (OU2 treatment system) or both. The combined facility is configured so that operators may utilize the most effective treatment element (i.e., unit operation) consistent with the results of the influent characterization.

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The design treatment capacity for the OU1 system is approximately thirty gallons per minute (gpm), and the average amount of groundwater recovered annually to date from OU1 has been approximately 450,000 gallons. There are significant flow fluctuations due to seasonal variations in the amount of groundwater collected via the OU1 collection system. The primary contaminants targeted for treatment by the OU1 system are chlorinated solvents such as carbon tetrachloride, which on average have been present in the influent at less than 10 parts per billion (ppb).

The design treatment capacity for the OU2 system is approximately sixty gpm, and the average amount of water recovered annually from OU2 has been approximately 120,000 gallons. Water is collected at several surface water collection spring boxes (via groundwater seeps) located at OU2. The primary contaminants targeted for treatment by the OU2 system are metals and two radionuclides, americium and plutonium.

Operable Unit 4 Treatment

Nitrate- and uranium-contaminated groundwater and surface water at OU4 is currently being collected by an interceptor trench system for treatment at Building 374. Nitrate/nitrite concentrations are generally less than 400 mg/liter (as nitrogen) at the ITS sump. Over the past two years, the nitrate/nitrite concentration has exhibited a downward trend. Also over the past two years, uranium concentrations have typically averaged approximately 135 pCi/liter. To date, other contaminants (e.g., organic contaminants, radionuclides, etc.) have not been present in OU4 groundwater in significant concentrations and may not require treatment in order to meet applicable water quality standards for treatment system effluent. Recovered groundwater and surface water are currently being treated at Building 374. The annual volume of water recovered and treated is highly variable, depending on precipitation levels, ranging from approximately 720,000 gallons in 1993 to 3,100,000 gallons during the first seven months of 1995.

Operable Unit 7 Landfill Leachate

Contaminated groundwater at OU7 currently drains into the Landfill Pond via surface seep SW-097. Treatment at this seep is expected to begin in June 1996 per the *Modified Proposed Action Memorandum Passive Seep Collection and Treatment Operable Unit 7, Final* (DOE, 1995). Effluent from the treatment system will enter the Landfill Pond, which, when necessary to maintain it at an appropriate level, will be discharged via a pump transfer to the A-series ponds.

2.2.4 Surface Water Collection, Treatment, and Discharge

Surface water runoff from the Site, including the industrial area, is collected in the A-, B-, and C-series ponds located in the North Walnut Creek, South Walnut Creek, and Woman Creek drainages, respectively. Additional surface water runoff from non-industrial areas of the Site collect in the Landfill Pond, located just northwest of the A-series ponds. Figure 2-2 provides general surface water drainage patterns for the Site. The Central Avenue Drainage Ditch and the South Interceptor Ditch direct significant industrial area surface water runoff to the B-series ponds and Pond C-2, respectively.

The A-, B-, and C-series ponds are the final components of water management at the Site. All of the ponds have similar water quality criteria applied to them since all the water managed through the ponds ultimately enters Segment 4 of Big Dry Creek, South Platte River Basin. These ponds are currently configured to provide detention of surface water runoff from industrial and non-industrial areas of the Site, WWTP effluent, landfill leachate, and treated water from environmental restoration activities. Under current pond management practices and normal operating conditions, all water discharged from the Site passes through either Pond A-4, Pond B-5, Pond C-1, or Pond C-2. Figure 2-4 shows the current flow configuration for the A-, B-, and C-series ponds as well as the Landfill Pond. A summary of current individual pond operations is included below. Valves referenced in the summaries can be located on Figure 2-4.

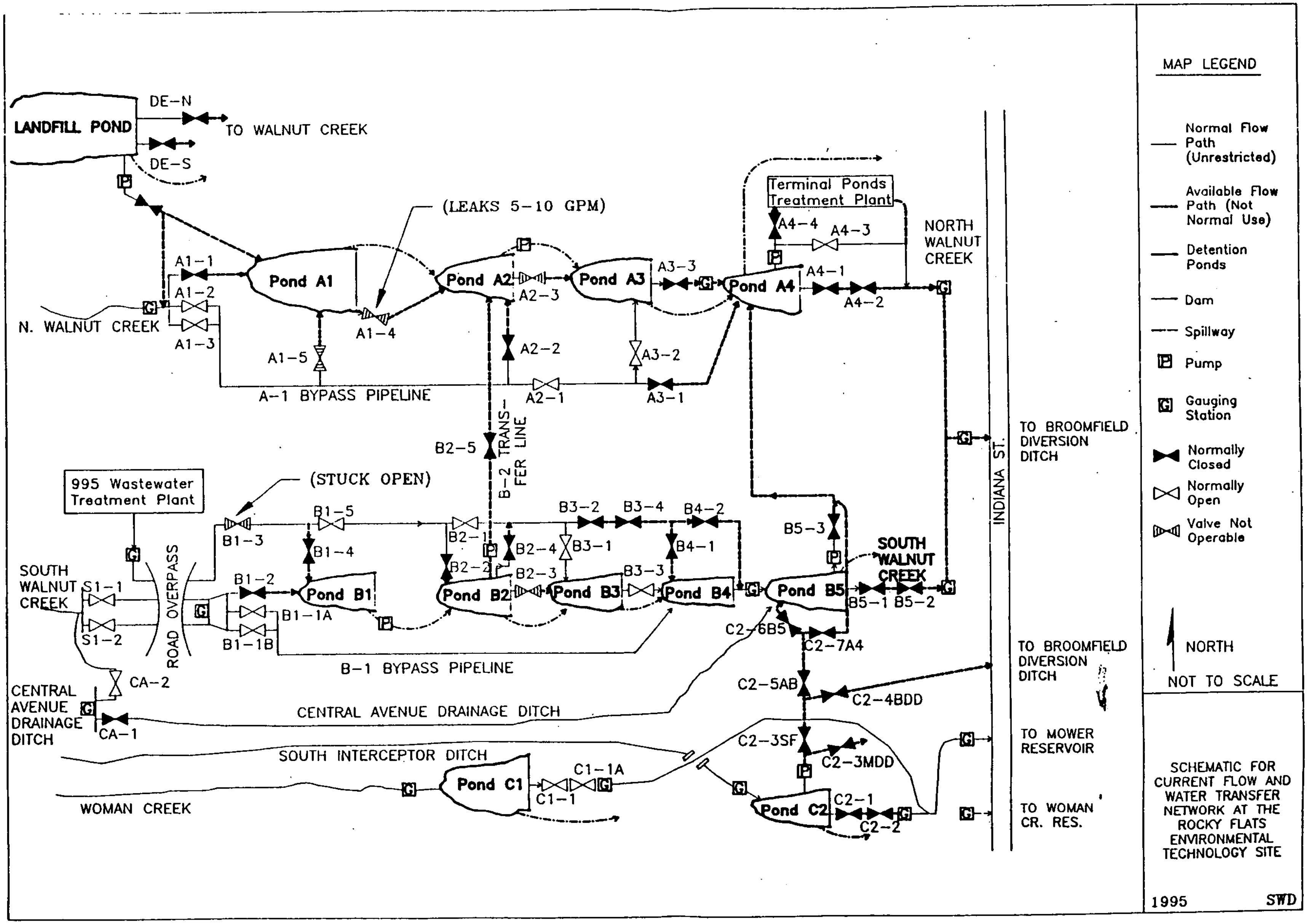

Figure 2-4. Flow Configuration for A-, B-, and C-Series Ponds.

Wetlands issues associated with the ponds are discussed briefly at the end of the section.

Note that emergency operations for the ponds are not discussed. Such operations are addressed in the draft *Rocky Flats Plant Pond Operations Plan* (DOE, 1995).

Landfill Pond

The Landfill Pond receives runoff from approximately eighteen acres at the northern part of the Site, just east of the existing Landfill (OU7). Occasionally, the Landfill Pond receives leachate via a seep from the adjacent landfill. Future actions associated with OU7 will lead to leachate treatment per the *Modified Proposed Action Memorandum, Passive Seep Collection and Treatment, Operable Unit 7* (DOE, 1995) and possibly lead to the elimination of leachate entering the pond, depending on final action taken at the landfill (e.g., an engineered landfill cover). Currently, water collected in the Landfill Pond is periodically pumped to either Pond A-1 or Pond A-3, with pump transfers to Pond A-3 occurring via the Pond A-1 Bypass Pipeline. Pump transfers only occur one to two times a year, depending on the level of precipitation received at the Site. Transfer to Pond A-1 or Pond A-3 is dependent on water levels in these ponds and holding capacity needs.

Pond A-1

Pond A-1 receives non-routine diversions of North Walnut Creek through valve A1-1, potential transfers from the Landfill Pond, and potential spills requiring emergency detention in the North Walnut Creek drainage. Pond A-1 discharge valve A1-4 is inoperable and leaks at about 5 to 10 gpm into Pond A-2. Because of the leak, Pond A-1 rarely fills to the level where water needs to be transferred via pumping operations.

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Pond A-2

Pond A-2 receives water from Pond A-1 through leaking valve A1-4, non-routine North Walnut Creek diversions via the A-1 Bypass Pipeline, and routine transfers from Pond B-2 via the B-2 Transfer Line. Discharges from Pond A-2 are infrequent and normally occur via a pump transfer to Pond A-3.

Pond A-3

Pond A-3 normally receives baseflow and stormwater runoff from the North Walnut Creek drainage via the A-1 bypass pipeline. Occasionally, Pond A-3 receives water transferred from Pond A-2 and the Landfill Pond. Pond A-3 is normally discharged through its outlet works into Pond A-4.

Pond A-4

Pond A-4 normally receives routine discharges from Pond A-3 and routine transfers from Pond B-5. Pond A-4 can also receive North Walnut Creek diversions via the A-1 Bypass Pipeline (through valve A3-1 when it is opened) and transfers from Pond C-2 via pipeline. Normal discharges from Pond A-4 are pump discharges to North Walnut Creek. Discharged water can be diverted to an existing pond water treatment facility prior to being directed to North Walnut Creek downstream of Pond A-4. During normal operations, Pond A-4 is where all offsite discharges occur. Discharges are in batches, following sampling. Discharges occur six to twelve times per year, and involve 100 to 200 million gallons.

Pond B-1

Pond B-1 normally receives water from non-routine diversions of South Walnut Creek, which can include potential diversions of surface water collected in the Central Avenue Drainage Ditch through valve B1-2. Pond B-1 can also receive piped effluent

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of the WWTP through valve B1-4. Pond B-1 is maintained as a spill control pond for the South Walnut Creek drainage. Discharges from Pond B-1 occur via pumping transfers to Pond B-2.

Pond B-2

Pond B-2 normally receives water via routine transfers from Pond B-1 and non-routine transfers from the WWTP. Pond B-2 is maintained as a secondary spill control pond for the South Walnut Creek drainage. Pond B-2 normally discharges via a pump transfer through the B-2 Transfer Line to Pond A-2.

Pond B-3

Pond B-3 normally receives water from the Site's WWTP through valve B3-1. Pond B-3 can also receive water transfers via pumping operations from Pond B-2; although, Pond B-2 water is normally transferred via pumping operations to Pond A-2. Pond B-3 is discharged to Pond B-4 through valve B3-3.

Pond B-4

Pond B-4 normally receives discharges from Pond B-3 as well as stormwater runoff from the Industrial Area via the Central Avenue Drainage Ditch via the B-1 Bypass Pipeline. Discharge from Pond B-4 occurs via its spillway to Pond B-5.

Pond B-5

Pond B-5 normally only receives water from the overflow of Pond B-4; however, Pond B-4 is very small (only 0.18 million gallons versus 24 million gallons for Pond B-5). Therefore, for all intents and purposes, retention time in Pond B-4 is very small and water passes through to B-5 quickly. Pond B-5 can receive stormwater runoff from the Site via the Central Avenue Drainage Ditch and water transfers from Pond C-2 via

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pipeline. Pond B-5 is normally discharged to Pond A-4 via a pump transfer; however, Pond B-5 has a standpipe and can discharge directly to South Walnut Creek through its outlet works.

Pond C-1

Pond C-1 receives Woman Creek flows. There is currently no active management in place for Pond C-1. Pond C-1 discharges offsite to Mower Reservoir.

Pond C-2

Pond C-2 is the stormwater detention pond for runoff originating from the southern portion of the developed plant site. Pond C-2 also receives treated effluent of the STF via the South Interceptor Ditch.

Management of Ponds as Wetlands

Walnut Creek downstream from the A- and B-series ponds contains nearly continuous linear wetlands along the entire length of the stream channels from the ponds to the eastern plant boundary, according to a recent wetland inventory (U. S. Army Corps of Engineers, 1994). The wetlands are narrow, confined to the channel and adjacent floodplain, and have a combination of riverine, palustrine, scrub-shrub, and forested wetlands. Some wetlands have relatively little vegetation. Other wetlands contain wetland vegetation typical of the region such as plains cottonwood, coyote willow, false indigo, baltic rush and cattail. There are also a few wetlands supported by seeps on the sideslopes downstream from the B-series ponds.

Wetlands associated with Woman Creek and the C-series ponds may be summarized as follows.

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- Pond C-1 is a palustrine wetland with an unconsolidated bottom. Its area is approximately 0.8 acres. Around pond C-1 are additional wetlands - approximately 0.1 acres of palustrine emergent (mostly cattails) and 0.6 acres of palustrine scrub-shrub (willows and leadplants). Downstream of pond C-1 are 0.44 acres of palustrine forested (cottonwood and willows), 1.2 acres of palustrine scrub-shrub (willows and leadplants), and 0.78 acres of palustrine emergent (cattails).

- Pond C-2 is a lacustrine limnetic wetlands (deepwater habitat) with an area of 3.87 acres. Around pond C-2 are 1.64 acres of palustrine emergent wetlands (mostly cattails). Downstream of pond C-2 are 4.5 acres of palustrine scrub-shrub (leadplant and willow) and 0.5 acres of palustrine forested (cottonwood, willow, and leadplant).

Some of the wetlands vegetation now found along Walnut Creek downstream from the ponds became established prior to the start of batch operations in 1989. This vegetation established during a time when flow from the ponds was more continuous than it has been under batch discharge. Wetland trees and shrubs that are able to persist under period of dryer conditions, have survived. Grasses and other ground cover, that respond more quickly to changes in hydrology, may have changed the past several years to the point that species that prefer drier conditions have become more dominant.

2.4 EXISTING SITEWIDE WATER BALANCE

Discussions in this section are based on a report compiled by the United States Geological Survey (USGS) for the DOE, dated November 13, 1995 (USGS, 1995). The USGS compiled existing RMRS data to calculate a surface water budget for the Site for water years 1993 and 1994. The report focused on a balance based on precipitation, stream discharge, water purchased from the DWB and evaporation from the ponds. This report was used to provide a baseline for the number displayed

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graphically in Figure 2.5 for 1995 with the exception of the gaging station numbers. The numbers reported by the gaging stations on Woman Creek and the effluent gaging stations located on Walnut Creek are extremely high in relationship to the historic averages. This was due to precipation events in 1995 that, because of soil saturation conditions, surface runoff was equivalent to a 100-year storm event.

Several assumptions were made to complete the calculations. Complete closure of the water entering and leaving the Site cannot be obtained for several reasons which include the assumptions made in calculating the percentage of precipitation that contributes to the surface water runoff. It was estimated to be eight percent of the total precipitation on the Site. The split between the two drainages was the variable chosen to close the water balance around each of the ponds, i.e. Woman and Walnut Creek, as shown in Figure 2.5.

Gaging stations measure the surface water entering the Woman Creek drainage (GS05 and GS06) and leaving the Site via Walnut (GS03) and Woman Creek (GS01 and GS02) drainages. Some data were missing and estimates were used to calculate the yearly totals.

Water purchased from the DWB is used sitewide as discussed in Section 2.2.2 of this document. Water losses due to evaporation, system leakage, construction, and process loss have been estimated. The only place that water is metered is at the discharge of the water treatment plant, Building 124, and the discharge of the WWTP, Building 995. These metered numbers were used along with estimates for various water streams at the Site to develop a reasonable overall balance of purchased water distribution.

2.5 WATER RECYCLE/REUSE

Water recycle and reuse is currently being implemented with evaporator water generated by the evaporator at Building 374. Currently, distillate from the Building

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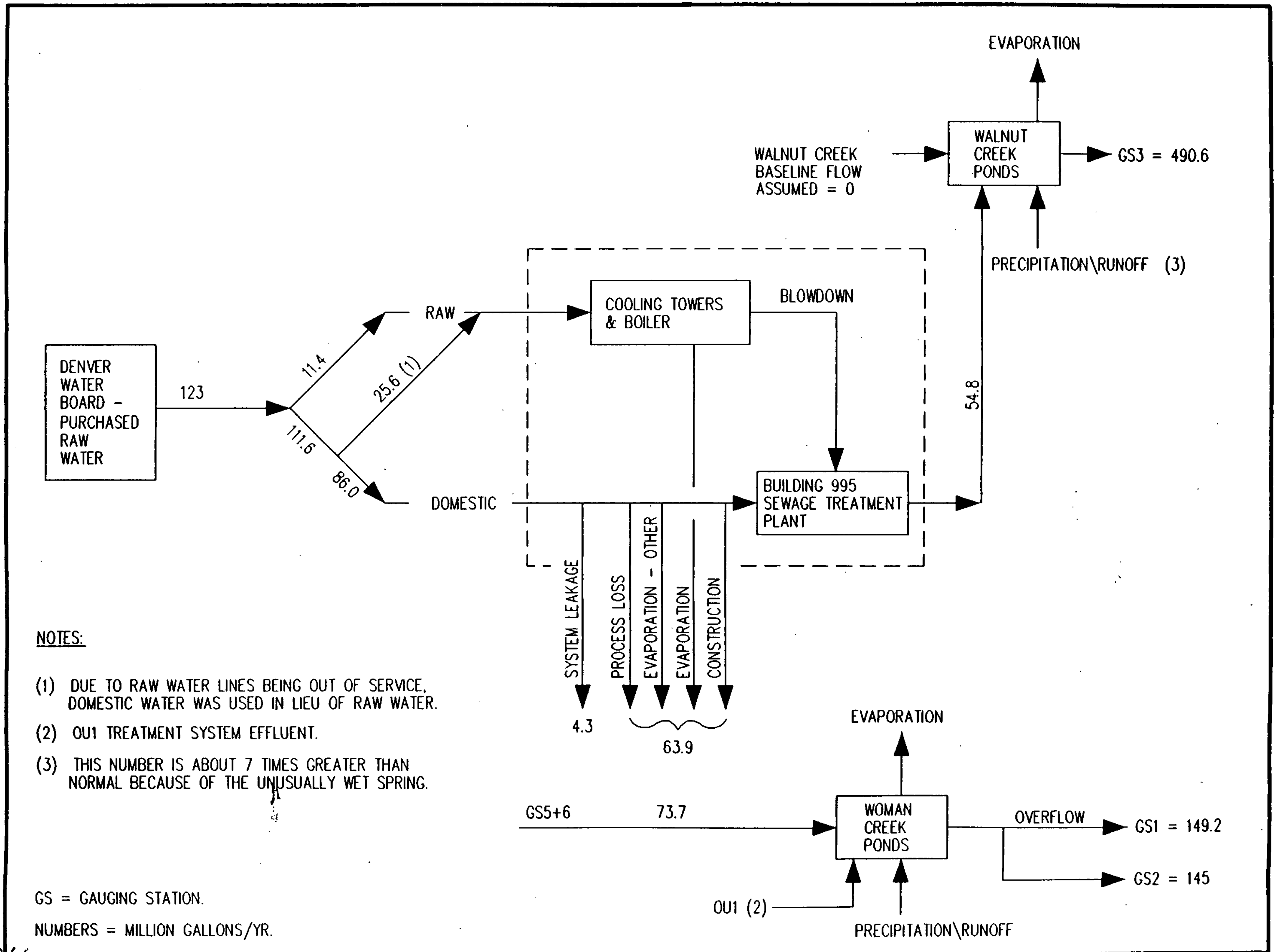

Figure 2-5 USGS Sitewide Preliminary Water Budget

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374 evaporator is directed to Site cooling towers and/or the Site Steam Plant. This source of distilled water will be phased out by the middle of the second quarter of Fiscal Year 1997 as the evaporators are shut down and Building 374 operations are replaced by a new Temporary Treatment Facility. No other sources have been identified for recycle or reuse at this time. Water recycle and reuse was studied extensively in Tasks 11 and 13 of the *Treated Sewage/Process Wastewater Recycle Study, Rocky Flats Plant Site* (EG&G, 1991). Conclusions reached by the study identified several potential recycle/reuse alternatives, but none were economically feasible.

2.6 WATER DISCHARGE

Currently, all water discharged from the Site is managed through operations at the A-, B-, and C-series ponds. As discussed in Section 2.1, discharges from Ponds A-3, A-4, B-5, and C-2 are governed by the current NPDES permit for the Site. Discharges from Pond C-1 in the Woman Creek drainage are not governed by the NPDES permit. Water passing offsite via Pond C-1 does so through gaging station (GS) 2 under normal Site conditions.

The total water discharged offsite via the A-, B-, and C-series ponds varies, depending on factors such as domestic and process water use, environmental restoration activities, and precipitation. As noted in Section 2.4, Existing Sitewide Water Balance, precipitation contributes the greatest variability in yearly discharges.

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3.0 SUMMARY OF FUTURE WATER MANAGEMENT PRACTICES AND NEEDS

This section projects trends in water use at the Site for the period of 1996 to 2010, reviews ongoing negotiations on ground water and surface water cleanup levels, and identifies expected water management practices and needs during this period. Similar to Section 2, Summary of Current Water Management Systems and Practices, relevant areas investigated for projecting future water management practices and needs include the expected regulatory environment, planned Site water management system components, and projected water needs, uses, treatment, etc. for the aforementioned period.

3.1 REGULATORY CONSIDERATIONS

The establishment of regulatory drivers applicable to the future management of water at the Site is an ongoing process involving negotiations among multiple stakeholders. These negotiations are centered around the draft RFETS Vision (DOE, 1995b) statement and the means by which the draft Vision will be realized, namely, implementation of the Accelerated Site Action Project [(ASAP) Phase II, (DOE, 1996c)]. Summaries of the draft RFETS Vision and the ASAP in terms of establishing the future regulatory environment for governing water management at the Site are included as dedicated sections below.

The new NPDES permit draft is limited to the regulation of discharges from the Wastewater Treatment Plant (WWTP), Building 374 and six stormwater outfalls, and no longer covers discharges from Ponds A-3, A-4, B-5, and C-2. No final permit has been issued for the Site. The most recent draft of the permit is currently under review by the EPA and DOE headquarters to evaluate enforcement authority.

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3.1.1 RFETS Vision

A draft Conceptual "Vision" for the Site has been agreed to by the RFETS Principals[1].

In general, the draft Vision statement is to have the Site cleaned up to a level that is consistent with planned future land uses in a much shorter timeframe than has been previously considered. A key assumption identified in the draft Vision is that the Principals endorse the selection of cleanup standards that will support reasonably anticipated land and water uses. To this end, the draft Vision identified the following cleanup strategies related to water management at the Site:

- Soil cleanup will protect surface water.
- Groundwater cleanup will protect surface water. Groundwater management and remediation strategies will include such things as source removal, treatment, containment, and hydraulic gradient management. No use of on-site groundwater will be allowed so as to protect the hydraulic gradients (to minimize horizontal and vertical migration of contaminants) and to preserve the open space character of the land.
- Surface water cleanup will protect the specified uses of the surface water, which is expected to be aquatic and recreational, not water supply.

The draft Vision identifies a final site condition, which is characterized by five areas, 0 - 4, shown in Figure 3-1. The draft Vision has been released for initial public comment. Comments will be incorporated into the Rocky Flats Cleanup Agreement (RFCA) which will go out for 60-day public comment. Each of these areas includes the following elements related to water management.

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1 RFETS *Principals include:* Tom Grumbly, Assistant Secretary for Environmental Management, Department of Energy; Tom Looby, Director, Office of Environment, Colorado Department of Health and Environment; Jack McGraw, Deputy Regional Administrator, EPA Region VIII; Gail Schoettler, Lieutenant Governor, State of Colorado; and Mark Silverman, Manager, DOE Rocky Flats Field Office.

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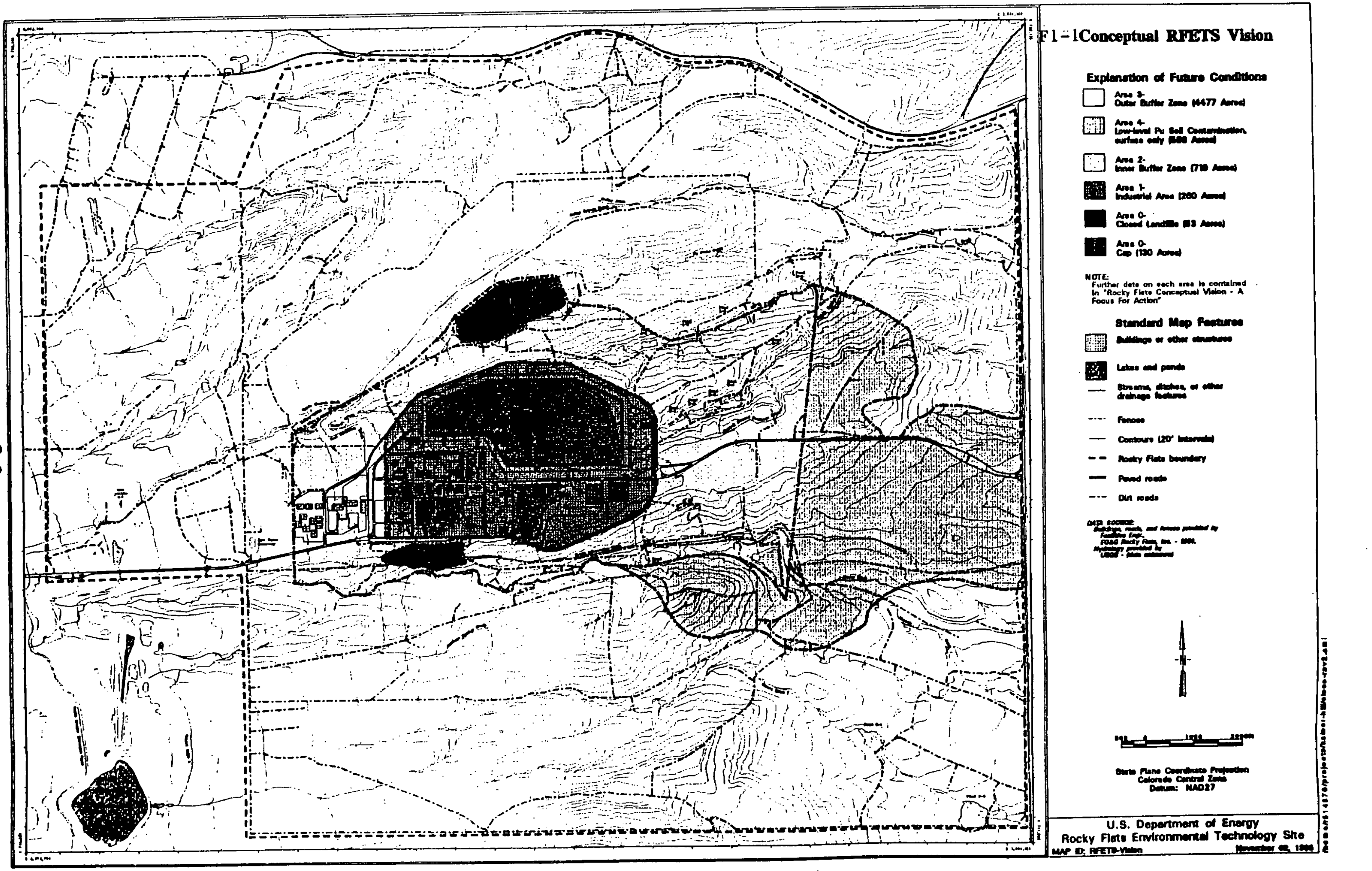

28 **Figure 3-1.** Future Land Uses at RFETS based on Draft Vision

Area 0: Landfills

There will be three or four capped areas left on the Site. There will be no use of groundwater or surface water for any purpose in Area 0. DOE will divert stormwater runoff consistent with normal stormwater management standards and will monitor and control groundwater to reduce contaminant migration and preserve the integrity of the landfills.

Area 1: Potential Industrial Use

Land Area 1 will be available for future industrial use; DOE will clean up this area to levels that are protective of surface water and reasonably expected human exposure in an industrial setting. There will be no groundwater or surface water use for any purpose in Area 1. As with Area 0, DOE will divert or otherwise control stormwater as required by best management practices. DOE will monitor and control groundwater to minimize horizontal and vertical migration of contaminants so as to protect land and water uses.

Area 2: Open Space (Inner Buffer Zone)

Land use in Area 2 will be open space. Use of surface water will be for ecological purposes; there will be no groundwater use for any purpose. The standards to govern the cleanup of Area 2 will be selected to protect surface water, the ecosystem, and reasonably expected human exposure in an open space setting. Existing ponds in the Walnut and Woman Creek drainages may remain for ecological purposes; however, none of the ponds will remain as part of the Site's wastewater treatment system.

Area 3: Open Space (Outer Buffer Zone)

Land use in Area 3 will be open space. This area is not contaminated. Both surface water and groundwater quality could support any uses; however, open space use limits access to water. No groundwater pumping in Area 3 will be allowed that could affect contaminant migration in Areas 0, 1, or 2.

Area 4: Open Space (Residual Plutonium Soil Contamination)

Land use in Area 4 will be open space. The quality of surface water in the Creeks that bound this area will support unrestricted use; the groundwater quality will also support any future use.

In short, the Draft Vision identifies preferable future land and water uses at the Site that are consistent with achievable Site cleanup measures. Land and water use will be significant in determining regulatory standards for governing future water management activities at the Site.

3.1.2 Accelerated Site Action Project

The ASAP is a planning and integrating project with the goal of radically reducing the risk associated with the inventory of nuclear and nonnuclear materials at the Site. This risk reduction would be accomplished at an accelerated pace and at significantly reduced cost compared with the Site's current planned course of action. The ASAP planning documents are the first attempt to determine a feasible alternative to accomplish the draft Vision. A section of the ASAP, Phase II, dedicated to environmental restoration, addresses the management of water at the Site under four Site cleanup options:

- Unrestricted Use - This option would involve the cleanup of the entire Site to a condition that would support residential use.
- BEMR 1 - This option represents early site planning that was published in the 1994 Baseline Environmental Management Report (BEMR), a congressionally mandated report.

- Intermediate Onsite Disposal - This option includes the remediation of Individual Hazardous Substance Sites (IHSSs) and groundwater to negotiated standards, capping a large portion of the Industrial Area, and disposal of most low-level and low-level mixed waste onsite in a RCRA Subtitle C type landfill(s). This option is consistent with the feasible alternative identified in the main text of the ASAP.

- Intermediate Containment - This option evaluates the cleanup of the Site to necessary and sufficient safety levels. Facilities would remain standing but vacant unless it makes economic sense to demolish them. This option would also include some on-site disposal.

The third option noted, Intermediate Onsite Disposal, is the focus of evaluation in the IWMS. As such, discussion in this section will be limited to specific regulatory requirements that could govern water management practices at the Site under the Intermediate Onsite Disposal option.

3.1.3 Standards Working Group

The Interagency Standards Working Group (DOE, EPA, CDPHE, and K-H Team) is evaluating risk-based values (i.e., risk-based preliminary remediation goals, applicable or relevant and appropriate requirements, and DOE Orders) to recommend cleanup levels by media based on the draft Vision statement. The following discusses cleanup levels under discussion for groundwater and surface water.

Groundwater

The need for groundwater remediation would be determined by the need to protect surface water or ecological resources. There would be a two-tiered approach to the application of standards and triggering of actions. In addition, the current, agreed upon, groundwater monitoring network would be fully utilized to determine the configuration of the contaminant plumes and changes in hydrologic conditions. The two tiers would be as follows:

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- Tier I - Action levels of 100 X Maximum Contaminant Levels (MCLs) will trigger remediation or management actions where appropriate.
- Tier II - Exceeding MCLs at wells located downgradient of plumes near surface water would trigger a different sequence of actions including evaluation and remediation where appropriate.
- Other - Exceeding MCLs in the groundwater monitoring network will trigger further evaluation.

The draft *Strategic Plan for the Management and Remediation of Groundwater at the Rocky Flats Environmental Technology Site* (RMRS, 1995b) identifies specific activities associated with groundwater at the Site. This plan for groundwater is discussed in detail in Section 3.3.3, Environmental Restoration Water Collection, Treatment, and Discharge.

Surface Water

Surface water standards were divided into two phases, those applicable to the Active Remediation period (Active Phase), and those applicable to the End-State achievement as identified by the draft Vision statement. The Active Phase is the time period between now and achievement of the interim state when active remediation and risk reduction will be occurring.

The Active Phase standards under discussion include:

- Point of compliance at the outfall of the terminal ponds (Ponds A-4, B-5, and C-2) for non-radioactive contaminants.
- Point of evaluation at the outfall of the terminal ponds for radioactive contaminants.
- Stream standard for non-radioactive contaminants would be Agricultural, Warm Water Aquatic 2 and Recreational 2.

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- Action level for ponds would be 0.15 picocuries per liter (pCi/liter) for plutonium and americium for a thirty day average.
- Exceedances of action levels will trigger some evaluation and potential mitigation.

The End-State standards under discussion include:

- Point of compliance at the outfall of the terminal ponds for non-radioactive contaminants.
- Point of evaluation at the outfall of the terminal ponds for radioactive contaminants.
- Action levels for plutonium or americium would be 0.15 pCi/liter for a 30 day average.
- Stream standards for the non-radioactive contaminants would be Warm Water Aquatic 2, Recreational 2, Water Supply.

It is assumed that final negotiated standards and goals recommended by the Interagency Standards Working Group and the Principals would be incorporated into the RFCA, made available for public comment and then brought to the Colorado Water Quality Control Commission (WQCC) as necessary. Final standards and goals would be reflected in the final NPDES permit issued for the Site.

3.2 BASIS FOR PROJECTIONS - ACCELERATED SITE ACTION PROJECT

The ASAP effort serves as the basis for making projections for the closure of buildings and for the number of personnel required to operate the Site. Based on the projections in ASAP Phase II, future water usage and treatment requirements can be estimated. Section 3 of ASAP Phase II, Facility Decommissioning, provides the bulk of the information needed for making these estimates.

3.3 PROJECTION OF WATER MANAGEMENT PRACTICES AND NEEDS

As noted in Section 2.2, there are four major components of the overall management of water at the Site: (1) raw water purchase and distribution; (2) domestic and process water use, treatment, and discharge; (3) environmental restoration water collection, treatment, and discharge; and (4) surface water collection, treatment, and discharge (includes the A-, B-, and C-series ponds). Each of these four components of water management will change as the Site undergoes cleanup, or, more specifically, as ASAP is implemented. Supporting calculations for the following projected water uses may be found in Appendix A of this document.

The processes and water management flowpaths noted in Figures 2-1, 2-2, and 2-3 will generally remain through implementation of ASAP. The most significant water management changes will stem from the use of a new Temporary Treatment Facility (TTF) for treating radionuclide-contaminated process wastewater; the possible treatment of nitrate and uranium-contaminated water from OU4 in a dedicated treatment facility or the possible discharge of the OU4 water without treatment; the use of source control and treatment systems (preferably passive) for contaminated groundwater control/remediation; and the implementation of the Pond Operations Plan, i.e., changing operation of the ponds from a batch to a controlled detention system. A batch mode of operation encompasses the water collection, sampling, verification of compliance prior to discharge and discharge. These changes and others are discussed in the following sections addressing future water management practices and needs at the Site.

3.3.1 Raw Water Purchase and Distribution

It is expected that raw water will continue to be purchased and distributed at the Site in a manner similar to current practices, with the only change over time being a steadily decreasing volume. The decrease in raw water purchase and distribution will result from the implementation of ASAP or some other Site "closure" process whereby a steady decrease in the Site workforce will effect a significant decrease in water needs at the Site. Figure 3-2 shows a projected decrease in water use at the Site to the year 2010.

As shown in Figure 3-2, water use supporting decontamination and decommissioning (D&D) and cap construction activities is projected to steadily increase to its peak demand near the end of ASAP. This water will be needed primarily for dust control during heavy equipment activities and clay layer construction during placement of engineered caps at the Site. Other D&D water requirements for decontamination pads and filling of void spaces in pipes and buildings with grout are expected to be minimal. The decrease in overall water use will be due to the steady decline in the number of personnel utilizing domestic water at the Site. Specifically, it is expected that the number of personnel utilizing domestic water at the Site will decrease from the current number of 5,000 by 600 per year through the year 2000. By the start of the year 2001, a stable population of 2,000 personnel should be established up until the year 2006, at which time it will again steadily decrease by about 300 per year through 2010, leaving the Site with approximately 500 personnel at the end of the RFETS active phase. The Site population will actually increase due to subcontractor personnel being on Site and involved with the D & D activities and construction of the Waste Management Facility. These subcontractors will bring their own drinking water onsite and sanitary disposal will be hauled offsite. Subcontractor population numbers combined with Site personnel are as follows:

Year	1996	1997	1998	1999	2000	2001	2002	2003
Pop.	5636	5905	6000	6842	7777	7500	7222	6944
Year	2004	2005	2006	2007	2008	2009	2010	2011
Pop.	6667	5882	5588	5294	5313	5000	3750	500

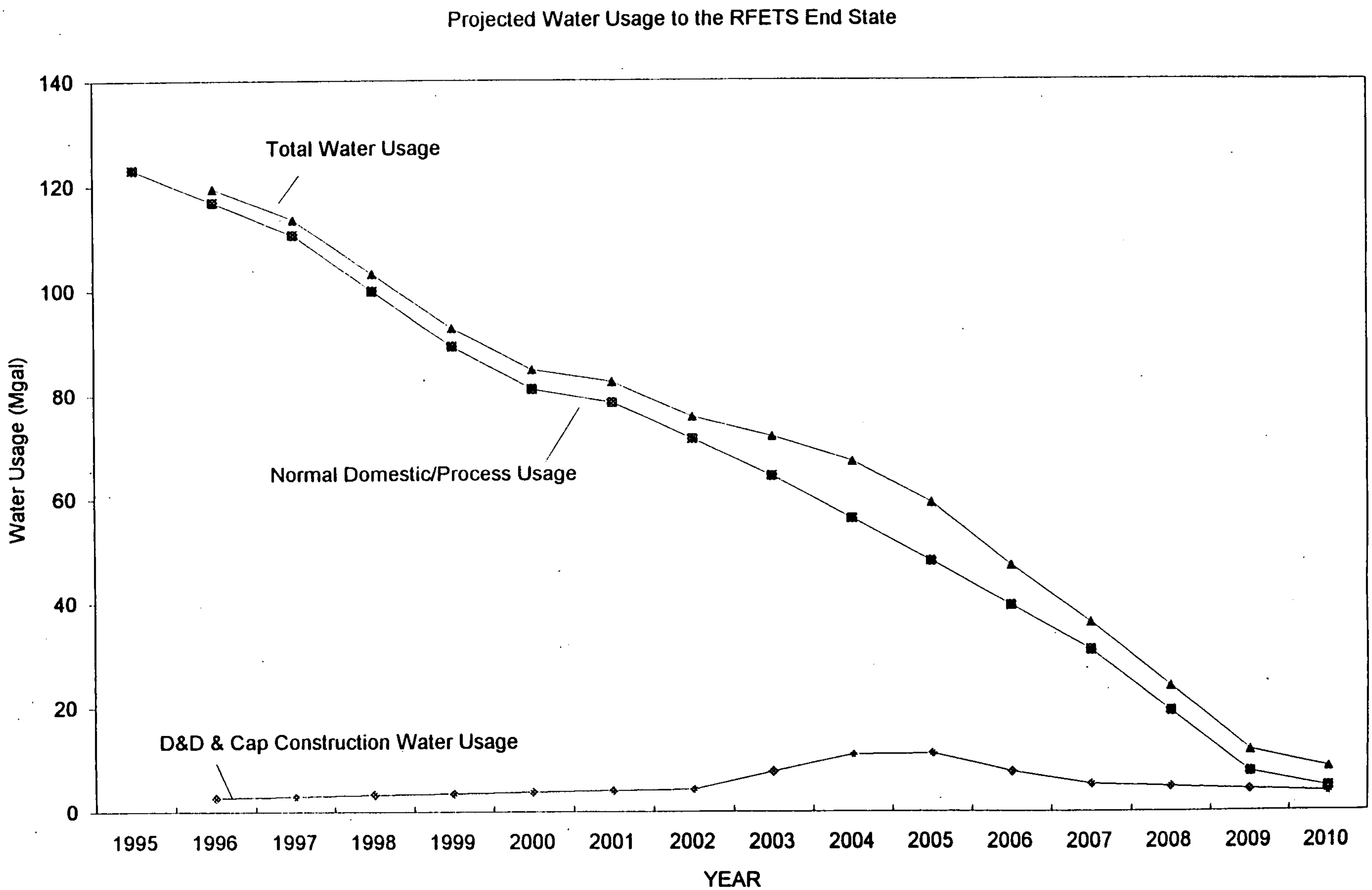

Figure 3-2. Projected Water Usage to the RFETS End State

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As ASAP is implemented, the need for treated raw water and, consequently, the need for Building 124 will decrease. Untreated raw water may be sufficient for D&D and cap construction activities.

3.3.2 Domestic and Process Water Use and Treatment

Domestic water will continue to be supplied to the Site through treatment operations at Building 124. Domestic, i.e., treated raw water, will be distributed for domestic water uses (e.g., toilets, showers, laundry, etc.) as well as limited process uses. Demand for domestic water as process water will likely be attributable to D&D activities at the Site during the implementation of ASAP, as discussed in the previous section. D&D activities requiring the greatest use of water are expected to occur in the final years of cap construction.

Domestic and process wastewater treatment will continue to be supported primarily by the WWTP, Building 995. The need for domestic wastewater treatment will steadily decrease with a decrease in personnel at the Site (see discussion in Section 3.3.1, Raw Water Purchase and Distribution). Process wastewater treatment at the WWTP will change beginning in 1997 as the WWTP will begin to treat effluent from the TTF, which will be constructed to treat wastewater associated with the draining/flushing of process systems that supported past radioactive materials operations at the Site. Effluent from the TTF will have to meet applicable criteria prior to transfer to the WWTP. Additional process wastewater from miscellaneous sources will be directed to the WWTP as has been done in the past. This wastewater will include cooling tower blowdown, regeneration water from softeners, and water from other miscellaneous operations. The quantity of process wastewater is expected to steadily decrease from the current level of approximately 7.3 MGY to zero by 2010 as a direct result of the process buildings being shut down.

Figure 3-3 shows the projected throughput of the WWTP attributable to domestic and process wastewater from miscellaneous sources as well as upcoming process wastewater from the TTF.

3.3.3 Environmental Restoration Water Collection, Treatment, and Discharge

The current active recovery and treatment of contaminated groundwater at the Site for the purpose of environmental restoration is expected to change per the draft *Strategic Plan for the Management and Remediation of Groundwater at the Rocky Flats Environmental Technology Site* (RMRS, 1995b), hereinafter referred to as the Groundwater Strategic Plan. The Groundwater Strategic Plan incorporates the draft Rocky Flats Conceptual Draft Vision (DOE, 1995b) and technical guidance from the Groundwater Strategy Working Group and the Interagency Standards Working Group. Under the Groundwater Strategic Plan, soil and groundwater cleanup will be completed to a degree that supports future land uses for the Site as identified in the draft Vision.

Protection of surface water is the primary driver for the expected cleanup and stabilization of contaminated subsurface soil and groundwater at the Site. The Interagency Standards Working Group reached a consensus in 1995 that protection of surface water, with respect to achievement of the draft Vision, would be the basis for making interim soil and groundwater remediation and management decisions. The Interagency Standards Working Group recognized that different standards may have to apply during active periods of site restoration, intermediate periods, and the end state.

Some of the proposed surface water standards differ from the existing site-specific surface water standards. Proposed standards will require public review and approval by the Colorado Water Quality Control Commission (WQCC). In general, the surface water standards will be selected to be protective of actual uses or reflective of

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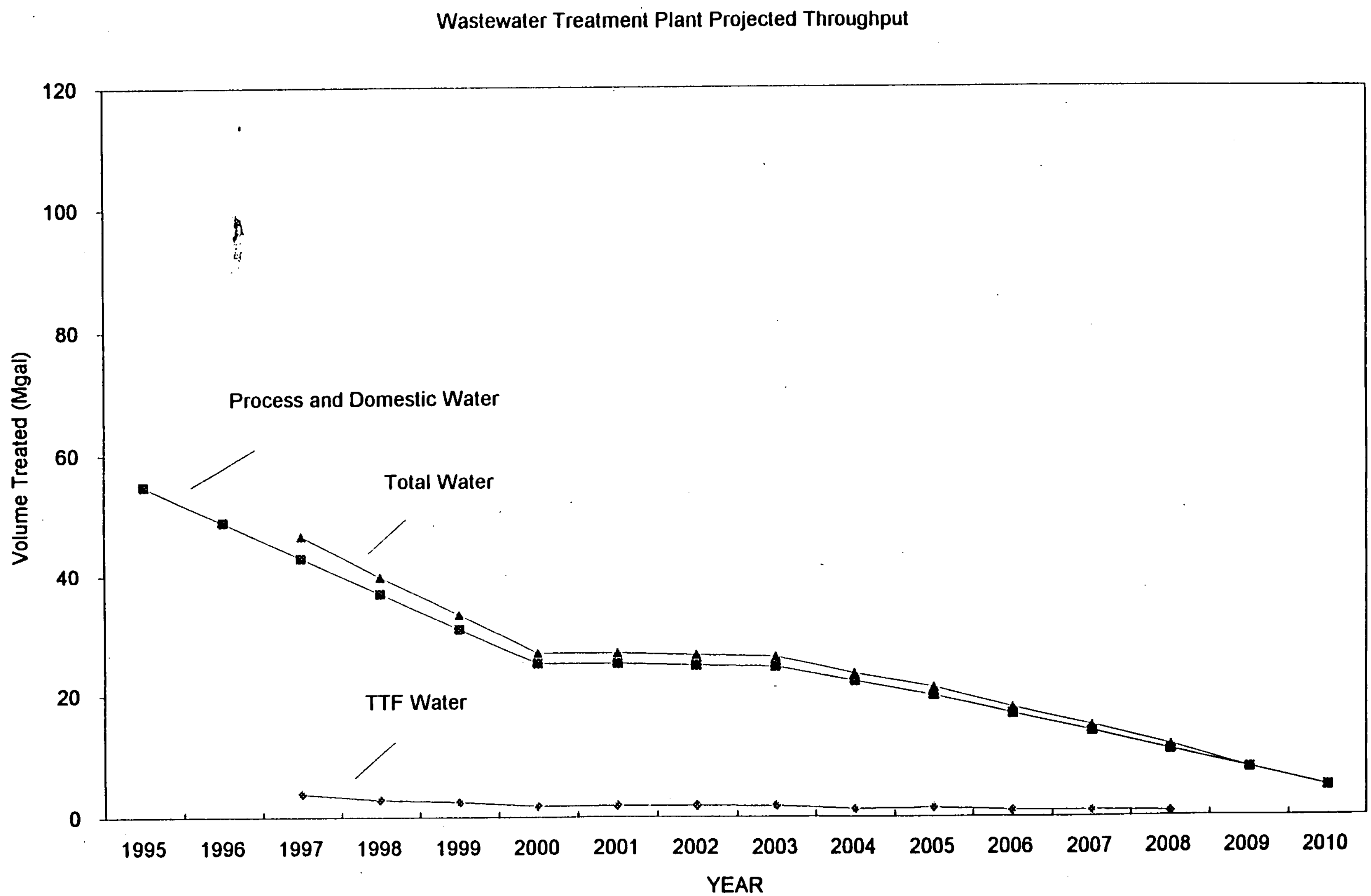

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Figure 3-3. Wastewater Treatment Plant Projected Throughput background levels at the Site. A detailed discussion of points of compliance or evaluation is included in Appendix B of the Groundwater Strategic Plan.

Action levels for groundwater must be protective of surface water quality and ecological resources. The framework for groundwater action levels assumes that all contaminated groundwater emerges as surface water before leaving the Site. Groundwater remediation would follow a two-tier approach with Tier I action levels governing near-source remediations and Tier II action levels governing the protection of surface water from contaminated groundwater. Tier I action levels are 100 X Maximum Contaminant Levels (MCLs) for organic contaminants. The Tier I action levels are designed to identify groundwater contaminant sources that present a potential risk to surface water and that should be addressed through an accelerated action. Tier II action levels are MCLs for organic contaminants. The Tier II action levels are designed to prevent groundwater contaminated above MCLs from reaching surface water by triggering groundwater management actions when necessary. Tier II action levels will be measured in designated wells.

Action levels for volatile organic compounds (VOCs) in subsurface soils were developed to be protective of groundwater and, ultimately, surface water. Note that metals are not normally mobile in Site groundwater and have not been addressed with action levels. A two-tiered approach to soil action levels was developed. Tier I addresses all subsurface soils capable of leaching VOCs to groundwater at concentrations greater than or equal to 100 X MCLs. Tier II action levels for subsurface soils are protective of human exposure on the basis of the construction worker exposure scenario.

Seven principal groups of groundwater plumes have been identified based on the existing monitoring well data: (1) 119.1 Groundwater Plume, (2) Mound Groundwater Plume, (3) 903 Pad Hillside Plume, (4) 118.1 Groundwater Plume, (5) East Trenches Area Plumes, (6) Industrial Area Plumes, and (7) Additional Plumes. Conceptual remedial actions for these plumes are outlined below. These actions were developed in the draft Groundwater Strategic Plan to provide a generalized solution based on current site conditions, the proposed regulatory framework, and the draft Vision. It should be noted that the lack of active groundwater recovery alternatives will mean that very little water from environmental restoration activities will potentially require treatment at the existing OU1/OU2 treatment facility.

The proposed conceptual groundwater remedial actions were developed using the following assumptions.

- Source removals or containment will be done for subsurface soils sources to be protective of groundwater concentrations at 100 X MCLs.
- Remediation and plume management will be done to preserve wetlands where possible, and will be implemented using cost-effective methodologies.
- The remediation and management decisions are based on the existing data set for groundwater plumes as well as on known technologies that are currently believed to be applicable.
- Where remedial actions are necessary, passive treatment or containment devices will be preferred and sited at a downgradient location coincident with the 100 X MCL boundary within the plume.
- An alternatives analysis for any proposed remedial action will be presented as an Interim Measure/Interim Remedial Action (IM/IRA) decision document or Proposed Action Memorandum (PAM).

119.1 Groundwater Plume

The proposed remedial action for groundwater primarily consists of source removal. Because most of the saturated soils containing groundwater contaminated above the 100 X MCLs would be excavated, the 881 French Drain and recovery wells would be removed from operation after the excavation is complete and upon demonstration the the proposed remedy has been effective. Removal of the French Drain and recovery

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wells from operation will eliminate a source of groundwater (approximately 450,000 gallons per year) currently treated with the OU1/OU2 treatment system.

Mound Groundwater Plume

To remediate the Mound plume, sources exceeding the Tier-I action level for soil cleanup criteria for VOCs would be removed from the Mound area. Groundwater with concentrations of VOCs in excess of 100 X MCLs would be collected through improvements to the existing collection system and treated by a system to be installed along the south bank of South Walnut Creek to prevent discharge of contaminated groundwater to surface water.

903 Pad Hillside Groundwater Plume

In the proposed remedy for groundwater in this area of the Site, contaminant sources exceeding applicable Site soil cleanup criteria for VOCs would be removed from the 903 Pad area. Groundwater remediation would involve a plume capture and treatment system installed at the plume front boundary defined by 100 X MCLs. Monitoring of treated groundwater and groundwater downgradient of the collection facilities for plume constituents would be conducted to ensure system performance.

118.1 Groundwater Plume

Proposed groundwater remediations for this plume include source removals for VOCs, after which the operation of the OU4 interceptor trench system would be discontinued. A potential remedy is placement of a slurry wall around the groundwater plume at the 100 X MCLs concentration boundary for the purpose of containment. According to the draft Vision and elements of the ASAP, the perimeter of the slurry wall would be overlain by a cap. The cap would be designed to minimize infiltration and prevent the buildup of excessive head within the containment structure.

East Trenches Area Plumes

In this area, sources exceeding applicable Site soil cleanup criteria for the Tier-I action level for VOCs would be removed, where feasible. Potential groundwater remediation would involve a combination of plume capture and passive treatment technologies installed at plume boundaries. Monitoring of treated groundwater and groundwater downgradient of the facilities for plume constituents would be conducted to ensure system performance. Groundwater treatment and system maintenance would likely be required for many decades.

Industrial Area Plumes

The proposed remedial actions for this area include removal of soils containing contamination above the Tier-I action level where feasible, eventual cut-off of man-made recharge from water supply lines and sewers, installation of a soil vegetative cover and/or regrading over the Industrial Area to limit natural recharge and contaminant leaching, and monitoring of groundwater plumes. Groundwater recharge in the Industrial Area caused by water losses from sewers and water supply pipelines is believed to be significant.

Under consideration are alternative remedial actions such as diverting groundwater flow upgradient of the Industrial Area and collecting contaminated groundwater within the Industrial Area by linking footing drains on selected buildings with new sections of horizontal drains connected to the existing Sitewide Treatment Facility (STF) in Building 891. The collection of contaminated groundwater within the Industrial Area does not appear to be necessary to achieve the draft Vision or the cleanup goals; however, groundwater collection may be necessary if the hydraulic conditions change causing mobilization of the plumes.

Additional Plumes

Landfill Plume. An interim remedial action currently under construction will include the installation of a gravity flow system designed to intercept the contaminated groundwater and leachate flowing from the landfill for the purpose of treatment. Treatment will include a settling basin, bag filter to remove additional suspended solids, and granular activated carbon to remove organic chemical constituents. final treatment will be determined by IM/IRA being prepared for OU7.

Solar Ponds Nitrate Groundwater Plume. An existing interceptor trench system currently captures groundwater contaminated with nitrate and uranium for periodic treatment at the existing Building 374 treatment facilities. Given the near-term shutdown of Building 374, an investigation is underway to determine the most cost effective replacement treatment system for the OU4 water. The need for treatment, however, must still be determined as there is the possibility that managed discharge of the ITS water through blending with the WWTP effluent and bypassing the B-series ponds will not require treatment to achieve necessary discharge concentrations. Specific remedial actions for the OU4 groundwater will be developed as needed in the future based on final cleanup standards developed for the Site. A review of monitoring data has shown that uranium concentrations are within background levels and the nitrate concentrations will not pose a human health risk once Option B (Broomfield Water Supply Project) is in place on January 1997. Reclassification of the stream use in the Walnut Creek drainage to a classification other than drinking water supply may eliminate the need for treating the recovered groundwater.

3.3.4 Surface Water Collection, Treatment, and Discharge

As noted in Section 2.2.4, surface water runoff from the industrial area of the Site is collected in the A-, B-, and C-series ponds located in the North Walnut Creek, South Walnut Creek, and Woman Creek drainages, respectively. Figure 2-2 provides general surface water drainage patterns for the Site. It is reasonable to expect that surface

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water drainage patterns at the Site will not change significantly through the implementation of ASAP; however, the amount of surface water runoff that collects in the drainages could decrease significantly. Changes will be dependent primarily on cap designs for those areas of the Site targeted for capping with an engineered cover. It is possible that regrading, revegetation or use of engineered vegetated covers will significantly offset runoff quantities.

The most significant change related to surface water collection, treatment, and discharge expected at the Site is the implementation of the *Pond Operations Plan* [(POP), (RMRS, 1995c)]. This plan describes the DOE Rocky Flats Field Office's transition plan for modifying the management of the onsite surface water detention ponds. A summary of the POP, with emphasis on the plan's relationship to other elements of water management at the Site, is provided below. It should be noted that the POP was written prior to the development of the TTF. The POP and its accompanying technical appendix may require some adjustment in consideration of receipt of TTF effluent. In general, however, the POP calls for transitioning pond operations to a mode of controlled detention - a mode of operation for the ponds that is desired regardless of the ponds' receipt of TTF effluent.

Pond Operations Plan

The draft Pond Operations Plan was issued to the regulators for comment in December, 1995. A brief review of the draft POP follows.

The A-, B-, and C-series ponds currently serve three main purposes for surface water management at the Site: (1) stormwater detention and settling of particulates, (2) holding water for sampling and, as necessary, treatment prior to being released, and (3) emergency spill control in those instances where a spill cannot be adequately managed without use of the ponds. These three purposes will remain through ASAP implementation; however, the methodology of pond operation will change. The Landfill Pond may be considered as part of the A-series ponds as it is pump transferred

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in batch only when it fills to a level that causes dam safety concerns. The transfers, typically to Ponds A-1 or A-2, occur one to three times per year and total up to seven million gallons of water annually. It is likely that the Landfill Pond will be eliminated as part of the remedial action expected to be taken for the landfill (OU7).

The POP describes the necessary steps in transitioning the operations of the Site's stormwater detention ponds (A-, B-, and C-series ponds) as components of Rocky Flats Surface Water Management Option B (Option B) are completed and placed in operation. Option B includes completion of the Woman Creek Reservoir in 1996 and the Broomfield Water Supply Pipeline in January, 1997. The POP outlines a phased approach where, as Option B is implemented, pond operations will transition to a controlled detention configuration from the current practice of batch and pumped discharge operation. Controlled detention has been determined to be equally as protective and more cost-effective than current batch releasing of pond water. The transition to controlled detention will occur gradually in four phases which take advantage of offsite protective measures and onsite capital improvements. Pond C-2 will continue to be operated in a batch discharge mode with batch discharges expected to be required only twice a year. Strict operations protocols for the A- and B-series ponds are identified in the POP.

Currently, a significant percentage of the water expected to be managed in the B-series ponds and discharged at the outfall of Pond B-5 will be effluent from the Site's WWTP. The WWTP effluent will steadily decrease as ASAP is implemented and as the number of personnel using the sanitary facilities on Site decreases. Final "closure" of the Site will likely entail the complete elimination of the WWTP; consequently, a significant year-round source of water to the B-series ponds will be eliminated. Depending on the time of year and precipitation levels from year to year, the B-series ponds may reach significantly low levels. Figure 3-2 shows the expected steady decrease in water processed through the WWTP to the year 2010. The decrease is due to a reduction in both domestic and process water usage. Domestic water usage will decline in direct proportion to the reduction in workforce that utilize the domestic water system. Process water will decline as the buildings are shut down. Contributions from the new TTF, which is scheduled to open in 1997, will gradually decrease until the TTF is shut down in 2008 to 2010.

A proposal is being evaluated to bypass the B-series ponds and discharge the WWTP effluent directly into lower South Walnut Creek. If the bypass is implemented there would be an immediate impact on the B-series ponds. Based on historical data, approximately 70 percent of the total annual flow to the B-series ponds is attributable to the WWTP effluent. During dry periods of the year this effluent contributes 100 percent of the flow. The bypass, if implemented, would lower the pond levels and increase their capacity to attenuate stormwater inflows and lower operating cost.

Management of Ponds as Wetlands

The change to a controlled detention system from the current batch discharge pondwater management system would likely result in some changes to the wetlands downstream from the A- and B-series ponds. If flows are consistent enough to saturate soils along the edges of the stream, vegetation that can tolerate saturated soil conditions would gradually replace any existing vegetation that cannot tolerate saturated soils. Water tolerant species that are commonly found on the Site, such as cottonwood, sandbar willow, leadplant, cattail, rushes, and sedges may become more prevalent in and adjacent to the stream.

As vegetation along Walnut Creek changes, the wildlife habitat provided by the vegetation would also change. If wetland vegetation increases, birds and animals that prefer wetland habitat would also be expected to increase. The Preble's Meadow Jumping Mouse, a species that is currently a candidate under the Endangered Species Act (ESA), has been found along Walnut Creek downstream of the ponds. Habitat for this species would be expected to increase and improve under a controlled detention system. Conversely, birds and animals that prefer vegetation found in drier areas could eventually find habitat along the stream channels less suitable as more wetland species invade, and these species may be forced to move to drier areas to find suitable habitat.

Aquatic habitat should be improved by more continuous flows, even though there is no guarantee that the flows would be of sufficient frequency or duration to support permanent populations of fish. Increased flows should at least result in an increase in aquatic invertebrates and other aquatic and semi-aquatic organisms that can survive and reproduce under periodically dry conditions.

Since there are no planned changes in the operational mode of the C-series ponds, there are no anticipated changes to their associated wetlands.

3.3.5 Summary of Projected Volumes

Water usage will decline steadily over the next fifteen years through the Site restoration process. Water use attributed to current users at the site will decrease from the present value of 123 MGY as buildings are closed and as the work force is decreased. For the period of 1996 through 2010 there will be additional water usage for dust control and wetting of the clay liner. This usage is estimated to peak at 11.25 MGY in 2005 and decline to 3.75 MGY by 2010. Total water usage for the year 2010 is projected to be 8.5 MGY assuming a plant population of 500 people. Plots of these usages are shown in Figure 3-2.

Along with the decrease in water usage there will be a corresponding decrease in the amount of water treated in the WWTP. The current contribution of process wastewater from various Site processes, e.g., cooling tower blowdown, resin regeneration, etc. to water processed in the WWTP is 7.36 MGY. The current contribution of domestic wastewater from the workforce is 47.4 MGY. Based on the D&D of the buildings and the reduction in workforce, the projected volume of wastewater requiring treatment for the year 2010 is 4.75 MGY. For the period of

1997 through 2008, there will be an additional input to the WWTF from the TTF. Plots for the projected flows through the WWTF are shown in Figure 3-3.

The volume of water requiring treatment as part of environmental restoration activities will be dependent on cleanup standards enforced and remedial alternatives implemented. The draft Groundwater Strategic Plan focuses on alternatives that utilize containment and passive treatment technologies. The draft plan indicates that there would be no significant long-term environmental restoration water treatment requirements at any dedicated treatment facility and that water treatment needs will be limited to relatively small volumes of contaminated water generated as a result of contaminant source elimination from isolated areas of the Site. The requirement for long term use of the Sitewide Treatment Facility will be evaluated when the Groundwater Strategy Plan is finalized and when a decision is made on where the decon water will be treated.

3.4 SUMMARY OF PROJECTED WATER BALANCE

Using volume data for projected water usage and projected water treatment (Figures 3-2 and 3-3) sitewide water balances for the years 2000, 2005 and 2010 were prepared as shown in Figures 3-4 through 3-6, respectively. The raw water usages were estimated from the base year (1995) by taking into account the reductions in cooling tower and steam requirements. System leakage was calculated as five percent of the domestic water except for the year 2010 when it is assumed to be zero. Also in the year 2010 it is assumed that there will no longer be any raw water requirements. The total projected flows through the plant, as measured by the gaging stations, are based on USGS data for the years 1993 and 1994. These values may change in future years due to variations in precipitation and as a result of construction of an engineered cover(s) at the site. Additional assumptions and supporting calculations for these projections may be found in Appendix A of this document.

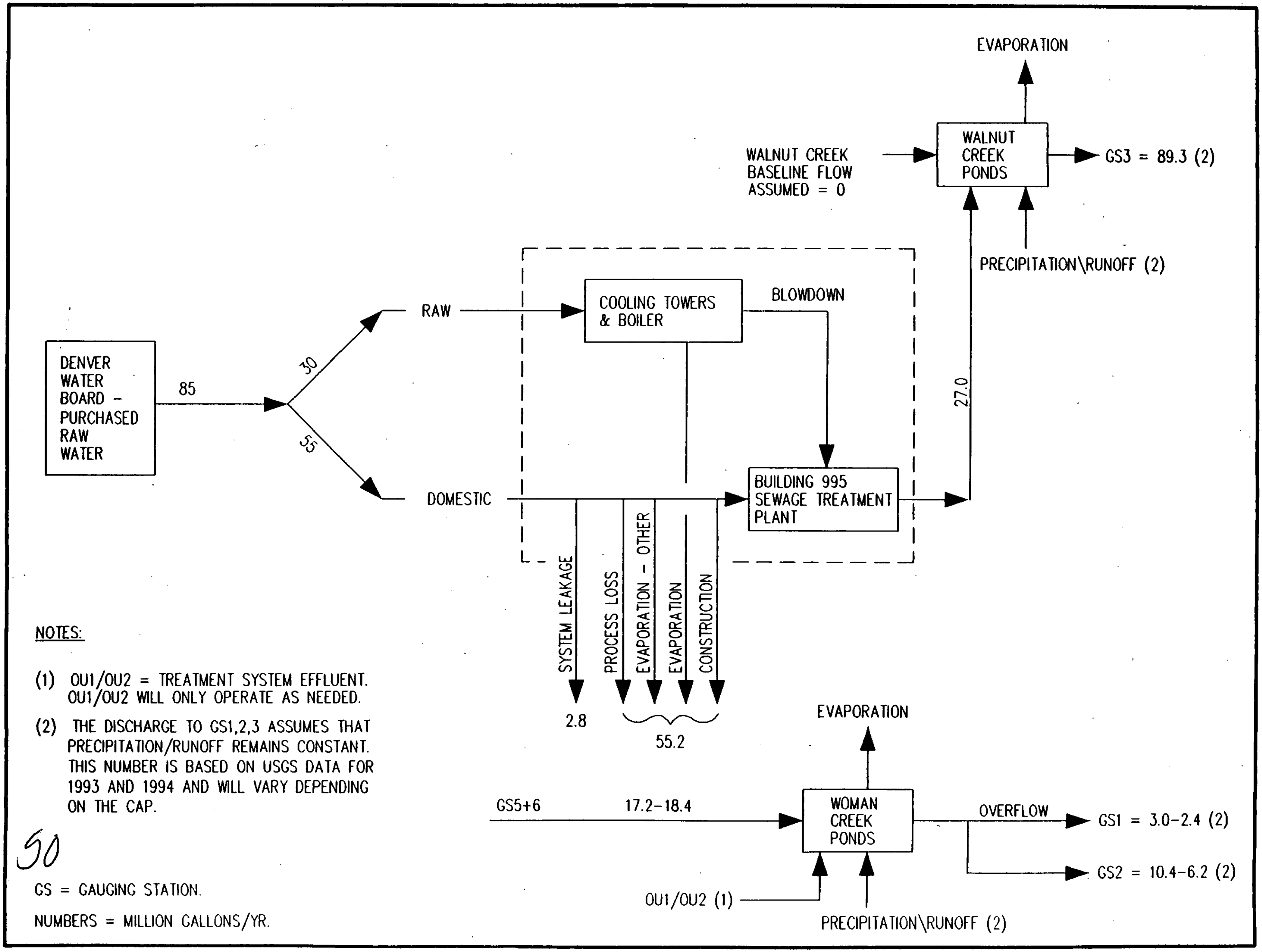
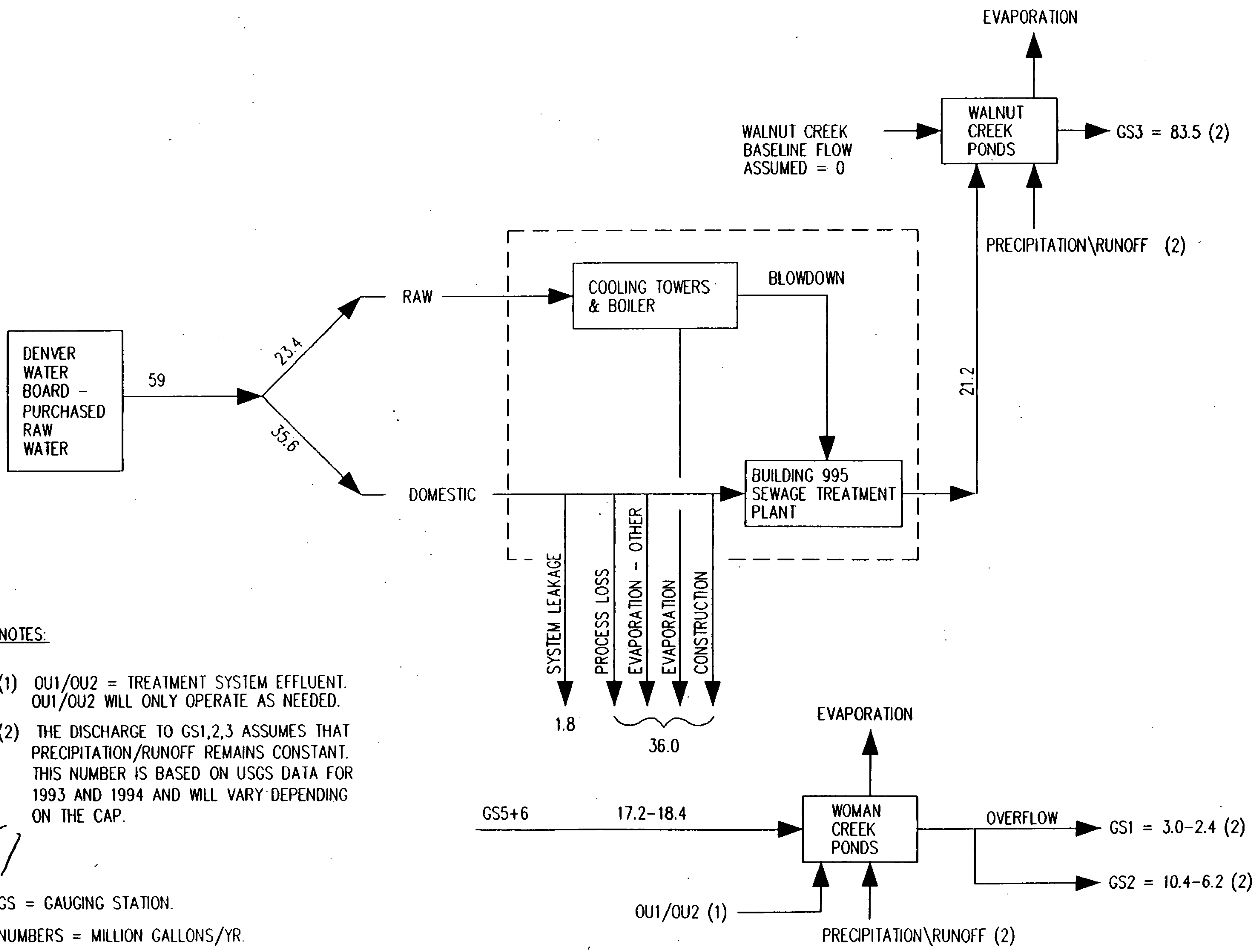


Figure 3-4. Projected Site Water Balance, 2000



NOTES:

(1) OU1/OU2 = TREATMENT SYSTEM EFFLUENT. OU1/OU2 WILL ONLY OPERATE AS NEEDED.

(2) THE DISCHARGE TO GS1,2,3 ASSUMES THAT PRECIPITATION/RUNOFF REMAINS CONSTANT. THIS NUMBER IS BASED ON USGS DATA FOR 1993 AND 1994 AND WILL VARY DEPENDING ON THE CAP.

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GS = GAUGING STATION.

NUMBERS = MILLION GALLONS/YR.

Figure 3-5. Projected Site Water Balance, 2005

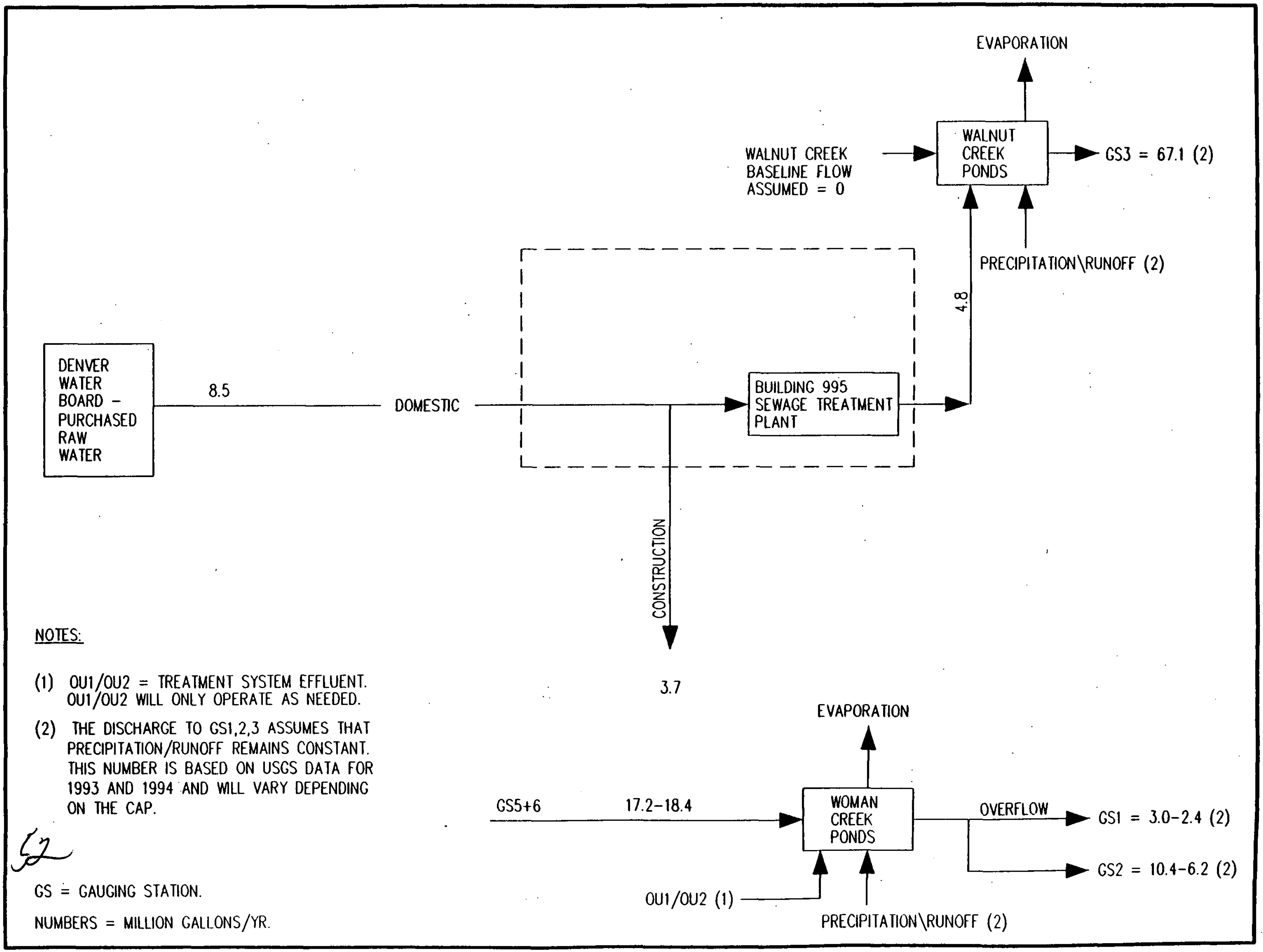

Figure 3-6. Projected Site Water Balance, 2010

4.0 EVALUATION OF WATER MANAGEMENT ALTERNATIVES

Three primary water management alternatives have been developed for the Site based on a series of assumptions. These assumptions and descriptions of the developed water management alternatives are provided in the following sections. In addition, the criteria used to evaluate each of the alternatives, including a criterion of impacts to wetlands, is presented, as is the detailed evaluation of each alternative to these criteria.

4.1 ASSUMPTIONS

The following assumptions were made in conjunction with alternative development.

4.1.1 General

- Site closure will be based on the draft of ASAP II, January 1996, and the Integrated Sitewide Baseline. The draft ASAP II projects the final capping of the Protected Area by the end of fiscal year 2010. For all intents and purposes, this will coincide with the closure of the site.

- An onsite waste management facility will be constructed for disposal of environmental remediation waste. It is expected that this facility will be constructed at the existing solar ponds location.

4.1.2 Surface Water

- The NPDES permit will be reissued by 1996 with outfalls at Ponds A-4, B-5, and C-2.

- Surface water management is based on the draft version of the *Pond Operations Plan and Pond Operations Plan Basis of Operations* [(POP/BOP), (RMRS, 1995c)]. The POP/BOP addresses current, near, and long-term operational modes for dams, transfers, and discharges and presents an approach for transition of pond operations for the A- and B-

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series ponds to a management regime with a flow through operation within the next two years. Flow through will be accomplished by an engineered flow through system, i.e., standpipes.

- Stormwater runoff will not require active treatment beyond the current system of detention ponds, and treatment is not contemplated for movement of water between ponds.

- In the future, ponds may be regulated under the Clean Water Act (CWA) or a new Federal Facilities Compliance Agreement.

- There will not be dams remaining on site in the future.

- No water will be purchased to maintain wetlands. Wetlands maintenance will have to rely on seeps and precipitation.

4.1.3 Groundwater

- Management of contaminated groundwater will be based on source removal and is addressed in the draft *Strategic Plan for the Management and Remediation of Groundwater at the Rocky Flats Environmental Technology Site* (RMRS, 1995b).

- To the extent possible, long-term treatment of contaminated groundwater will be by use and maintenance of reactive barrier walls or other passive technologies.

- Leachate collected from landfills will be managed by passive treatment systems or collected and treated offsite.

4.1.4 Raw Water

- Raw water demand will decrease as closure activities proceed and will end when ASAP has been completed. Water for domestic use and for fire water will be obtained by connecting to a municipal system with appropriate booster pumps and at-grade storage for fire water will be installed.

4.1.5 Wastewater Treatment

- The *Sitewide Wastewater Treatment Strategy* (RMRS, 1995a) will be implemented and Building 374 will be eliminated. Requirements for wastewater treatment will continue to decrease as closure proceeds and will be eliminated when ASAP has been completed.

- New sewer lines will be installed and a new small, zero-discharge sewage lagoon system constructed to handle/treat sanitary wastewater generated as a result of activities after ASAP.

- A Temporary Treatment Facility (TTF) will be designed and constructed to treat process water generated from building operations, building deactivation, and decontamination and decommissioning activities that potentially contain radionuclides. The TTF will replace the basic function of Building 374, but in a more cost-effective manner.

4.1.6 Surface Soils

- The Interim Measures, Interim Remedial Action (IM/IRA) for the 903 Pad will be implemented within the next two years.

- Surficial soil contamination above cleanup levels will be excavated and placed under a cap, cover(s), in on-site storage, or in basements of buildings.

4.2 DESCRIPTION OF ALTERNATIVES

Three primary alternatives have been developed for overall water management at the Site. The methodology used to develop these primary alternatives is provided in the following section. In addition, the alternatives themselves are summarized, and based on secondary discriminating factors, several sub-alternatives are described.

Note that the alternatives developed in the following section are primarily focused on management of water during active periods of operation at the Site. However, a complete evaluation of water management must also consider the period of time after site operations are reduced to a maintenance mode only. Alternatives for this long-term maintenance period will be developed after the selection of the primary water management alternative.

4.2.1 Elements of Water Management Alternatives

The primary elements that must be incorporated into water management alternatives include the following.

- Surface water management as discussed in the POP/BOP;
- Groundwater management and environmental restoration;
- Monitoring programs required to ensure compliance with applicable standards; and
- Water treatment systems required to ensure compliance with surface water discharge standards.

Incorporation of each of these elements into each alternative ensures that an overall integrated approach will be taken for water management. In addition to the four primary elements, the general issue of water rights and ecological impacts must be considered in order to implement water management alternatives. Appropriate mitigation measures, if any, must be identified. This general issue will be discussed during the detailed evaluation of each alternative.

4.2.2 Alternatives Development Methodology

Primary Discriminator

The primary discriminator in the development of the alternatives is the applicable radionuclide standards or treatment goals. The three scenarios with respect to radionuclide standards or goals include the following.

- Existing state standards for radionuclides for both the Walnut Creek and Woman Creek drainages. These standards are specific to the Site, and are based on ambient concentrations in the respective drainages.

- Risk-based treatment goals for radionuclides as currently being discussed by the Interagency Standards Working Group. The most restrictive risk level under discussion (10^{-6} excess cancer risk based on drinking water) will be the basis for this alternative.

- Risk-based treatment goals for radionuclides to be implemented at the completion of the Active Phase of site restoration with a temporary modification for higher radionuclide discharge levels during the Active Phase. The temporary modification would also be based on risk (10^{-4} excess cancer risk based on drinking water), and would only apply to the Walnut Creek drainage.

It should be noted that the drinking water assumption as the basis for risk calculations is conservative. With the implementation of Option B, discharges from the Site will not be used as a drinking water source by any of the local communities.

Secondary Discriminators

In addition to the radionuclide standards or goals, there are several additional scenarios with the potential to impact water management at the Site. Specifically, there are multiple scenarios with respect to applicable surface water standards for non-radionuclides. These scenarios include the following.

- Agricultural criteria;

- Drinking water criteria; and

- Water plus fish criteria.

The applicability of these criteria has the potential to impact both surface water management as well as groundwater management activities at the Site regardless of the radionuclide standards, and must be considered.

Final Alternatives Development Approach

Three alternatives have been developed based on the primary discriminators described above. These alternatives include the following.

- Alternative 1 - Existing Standards Alternative - This alternative assumes that the existing surface water standards for radionuclides remain in place.

- Alternative 2 - 10^{-6} Risk Alternative - This alternative assumes that the most restrictive proposed risk-based standards for radionuclides are implemented.

- Alternative 3 - Temporary Modification Option - This alternative recognizes that the conditions during the Active Phase of Site restoration will be quite different than those at the End State. Therefore, a temporary increase in radionuclide standards is assumed. Similar to Alternative 2 this increase is also risk-based, but uses a threshold risk level of 10^{-4}.

Each of these alternatives will be fully developed with respect to the four primary water management elements. After the alternatives are fully developed, the secondary discriminators will be applied to see if any sub-alternatives are warranted. For example, a specific approach and required actions to meet the existing standards for radionuclides may also result in the ability to meet agricultural criteria without any modifications or impacts to surface and groundwater management, monitoring programs, or wastewater treatment. However, this same approach may not be capable of meeting drinking water or water plus fish criteria without impacts and modifications to one of the four water management elements.

4.2.3 Detailed Description of Alternative 1 - Existing Standards Alternative

Alternative Summary

This alternative assumes that existing site-specific radionuclide standards remain in place. These standards vary between Walnut Creek and Woman Creek, and are based on ambient background radionuclide concentrations. The specific numerical values are summarized in Table 4.1 as follows.

Table 4-1. Existing surface water radionuclide discharge standards/goals.

Parameter	Discharge Standard (pCi/liter)	
	Walnut Creek	Woman Creek
Gross alpha activity	11	7
Gross beta activity	19	5
Americium	0.05	0.05
Plutonium	0.05	0.05
Uranium (total)	10	5

Surface Water Management

Management of the A-, B-, and C-series ponds is the key element of surface water management at the Site. The A- and B-series ponds are located in the Walnut Creek drainage, while the C-series ponds are located in the Woman Creek drainage. The *Pond Operations Plan and Pond Operations Plan Basis of Operations* (RMRS, 1995c)

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would be implemented to govern pond operations. It should be noted that the POP/BOP is focused on the control of plutonium and americium and that future operations of the A-, B-, and C-series ponds would be conducted independently of one another, i.e., there would be no hydraulic connections between the three series of ponds under normal operations.

The current revision of the POP/BOP assumes that the ponds must be operated with a goal of maintaining compliance with the existing radionuclide standards (see Table 4-1) at the outfalls of ponds A-4, B-5, and C-2. The POP/BOP did not, however, assume that a potential new contributor of radionuclides to the B-series ponds would be present in the future. Specifically, the existing POP/BOP did not consider the potential impacts of radionuclides being discharged to Pond B-3 via the WWTP as a result of the TTF effluent being directed to the WWTP. Based on the current design of the TTF, a system with dissolved solids removal capability, i.e., evaporation, it is reasonable to assume that plutonium and americium would enter the WWTP and, subsequently, the B-series ponds at concentrations less than or equal to the existing site-specific standard of 0.05 pCi/liter for each contaminant as a result of future wastewater treatment operations. Also, the volume of water entering the B-series ponds from TTF operations (estimated to range from 3.7 MGY at the start of the active phase to less than 1 MGY at the end of the active phase) would be insignificant relative to the South Walnut Creek baseline flow, surface water runoff, and the WWTP baseline effluent level (estimated to range from 55 MGY at the start of the active phase to 5 MGY at the end of the active phase). In short, no significant changes to the operations protocol identified in the POP/BOP would be required to support Alternative 1 during much of the active phase of Site restoration.

The implementation of the POP/BOP is not expected to be impacted by contaminants other than plutonium and americium. An evaluation of potential impacts to water management associated with other contaminants and the secondary discriminators identified in Section 4.2.2 is included in Section 4.2.6.

Groundwater Management

Future groundwater management at the Site will be consistent with the *Strategic Plan for the Management and Remediation of Groundwater at the Rocky Flats Environmental Technology Site* [Groundwater Strategic Plan, (RMRS, 1995b)]. Generally, areas of groundwater at the Site include contaminant plumes that are primarily limited to the following organic contaminants: carbon tetrachloride, trichloroethylene, tetrachloroethylene, 1,1-dichloroethene, and vinyl chloride. The Groundwater Strategic Plan focuses on achieving groundwater quality that is protective of surface water quality by utilizing containment and passive treatment technologies at locations around the Site. The Groundwater Strategic Plan identifies a two-tiered approach that includes the use of maximum contaminant levels (MCLs) as standards against which the protection of surface water will be evaluated. Since plutonium and americium do not exist in groundwater at the Site, the potential enforcement of the 0.05 pCi/liter surface water standard for each of these radionuclides (i.e., the basis of treatment requirements under Alternative 1) will have no impact on potential treatment needs for groundwater.

Uranium and elevated levels of nitrates are present in groundwater currently recovered by the ITS at OU4. The continued recovery of this groundwater is uncertain. If recovery continues, treatment for nitrate destruction followed by uranium removal would be implemented.

Monitoring Programs

A comprehensive monitoring program must be in place to ensure compliance with surface water discharge standards/goals. The monitoring program will be designed with specific data quality objectives (DQOs) that will influence the designation of data collection points and activities associated with obtaining the data. The *Pond Operations Plan and Pond Operations Plan Basis of Operations* (RMRS, 1995c) calls for a change in pond operations to controlled detention, which will require a modification of the existing monitoring program.

It is expected that the points of compliance for future pond operations will be the outfalls of ponds A-4, B-5, and C-2. As such, monitoring points would be selected and a monitoring program developed to provide appropriate assurance that compliance is maintained. The development of a monitoring plan for the pond discharges would likely involve negotiations among stakeholders. It should be noted that regardless of the discharge standards/goals established for Site discharges via the ponds, the number of sampling locations and the frequency of sampling events to determine compliance should not vary. Currently, monitoring involves sampling at Pond A-4 to verify compliance with existing standards prior to each planned batch discharge event.

Groundwater monitoring would be consistent with the Groundwater Monitoring and Assessment Plan as described in the Groundwater Strategic Plan (RMRS, 1995b). Groundwater monitoring data would only be used to evaluate changing hydrogeological conditions and the need for groundwater control/remediation efforts and is not an integral part of the ponds discharge monitoring program. Groundwater does not contain plutonium or americium and, therefore, would not be affected by the plutonium and americium standards/goals set for governing the release of these contaminants from the Site via surface water. Uranium is present in water collected by the ITS. Monitoring requirements for uranium in groundwater are contingent on final actions taken to address OU4, e.g., an engineered cover for the OU4 area, the discontinuation of ITS groundwater recovery operations, etc.

Water Treatment

For this alternative, the existing site-specific radionuclide standards for plutonium and americium of 0.05 pCi/liter must be met. All process wastewater resulting form building operations, building deactivation, and decontamination and decommissioning that could potentially contain radionuclides would be treated in the TTF.

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Influent wastewater to the TTF would be received and stored in tanks until pumped to a forced circulation crystallizing evaporator. The evaporator design ensures that the solids are maintained in suspension at all times. The slurry would be concentrated to approximately 70 percent total solids. Adsorbent material would be added to the slurry as necessary to stabilize any remaining liquids. Plutonium and americium levels in the distillate would be reduced to below the regulatory limit of 0.05 pCi/liter and, likewise, levels for gross alpha and beta activity and uranium would be reduced to below their regulatory limits

4.2.4 Detailed Description of Alternative 2 - Risk-Based Goals

Alternative Summary

This alternative assumes that 10^{-6} risk-based goals for radionuclides would be implemented for surface water discharged from the terminal ponds. The specific numerical values are as follows.

Table 4-2. 10^{-6} risk-based goals for radionuclides in surface water.

Parameter	Discharge Standard (pCi/liter)	
	Walnut Creek	Woman Creek
Americium	0.145	0.145
Plutonium	0.15	0.15
Uranium[1]	30	30

1 This standard for uranium is .....

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Surface Water Management

As noted for Alternative 1, the current revision of the POP/BOP assumes that the surface water ponds must be operated with a goal of maintaining compliance with the existing radionuclide standards (see Table 4-1) at the outfalls of Ponds A-4, B-5, and C-2. With the increase in the surface water standards for plutonium and americium by a factor of three to 0.15 pCi/liter under Alternative 2, there is the potential that the controlled detention flowrates for the A- and B-series ponds may be able to increase without jeopardizing the ability of the ponds to maintain compliance with the 0.15 pCi/liter standards. Also, with these standards for plutonium and americium, the TTF would be subject to performance requirements that are three times less stringent than under the standards for Alternative 1. However, it is believed that the unit operations for the TTF necessary to achieve the standards under Alternative 2 would be no different than those necessary for Alternative 1, i.e., an evaporative treatment system. Therefore, given the relationship between the TTF effluent, the WWTP effluent, and the B-series ponds as discussed for Alternative 1, it is reasonable to assume that plutonium and americium would enter the WWTP and, subsequently, the B-series ponds, at concentrations less than or equal to the Alternative 2 risk-based standard of 0.15 pCi/liter for each contaminant as a result of future wastewater treatment operations. Also, the volume of water entering the B-series ponds from TTF operations would be insignificant relative to the South Walnut Creek baseline flow, surface water runoff, and the WWTP baseline effluent level. Again, as with Alternative 1, no significant changes to the operations protocol identified in the POP/BOP would be required to support Alternative 2, although, it may be possible to increase the allowable flowrates under controlled detention operations.

Groundwater Management

Groundwater management would be the same under Alternative 2 as described for Alternative 1, with the exception that the increase in the uranium standard may preclude the need for its removal from groundwater that may be recovered by the ITS system.

Monitoring Programs

Monitoring under Alternative 2 would be as described for Alternative 1.

Water Treatment

For this alternative risk based goals of 0.15, 0.15, and 30 pCi/liter for plutonium, americium, and uranium, respectively, must be met. Since the limits for plutonium and americium are only slightly higher than the limits specified in Alternative 1, the same technology would be used. Refer to Section 4.2.3 for a description of the process. The standard for uranium is readily achievable with the technologies applied for plutonium and americium.

4.2.5 Detailed Description of Alternative 3 - Temporary Modifications

Alternative Summary

This alternative assumes that a temporary modification to the 10^{-6} risk-based goals identified for Alternative 2 for radionuclides will be implemented for surface water discharged from the terminal ponds. This modification, based on temporary 10^{-4} risk-based radionuclide concentrations, would only remain in place until completion of the Active Phase. The specific numerical values are as follows.

Table 4-3. 10^{-4} risk-based goals for radionuclides in surface water.

Parameter	Discharge Standard (pCi/liter)	
	Walnut Creek	**Woman Creek**
Americium	15	15
Plutonium	15	15
Uranium[2]	30	30

Surface Water Management

As noted for Alternative 1, the current revision of the POP/BOP assumes that the ponds must be operated with a goal of maintaining compliance with the existing radionuclide standards (see Table 4-1) at the outfalls of Ponds A-4, B-5, and C-2. With the increase in the surface water standards for plutonium and americium by a factor of 300 to 15 pCi/liter under Alternative 3, there is the potential that the controlled detention flowrates for the B-series ponds may be able to increase without jeopardizing the ability of the ponds to maintain compliance with the 15 pCi/liter standards. It is reasonable to assume that the controlled detention flowrates for the A-series ponds would be able to increase significantly given that, unlike the B-series ponds, the A-series ponds are not hydraulically connected to the TTF. With these 15 pCi/liter standards for plutonium and americium, the TTF would be subject to performance requirements that are 300 times less stringent than under the standards for Alternative 1. As such, it is expected that the unit operations for the TTF necessary to achieve the standards under Alternative 3 could be limited to chemical precipitation and microfiltration - unit operations that are significantly less complex than the unit operations necessary to support treatment under Alternatives 1 and 2. Given the relationship between the TTF effluent, the WWTP effluent, and the B-series ponds as discussed for Alternative 1, it is reasonable to assume that plutonium and americium would enter the WWTP and, subsequently, the B-series ponds at

2 The standard for uranium.....

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concentrations less than or equal to the Alternative 3 temporary risk-based standard of 15 pCi/liter for each contaminant as a result of future wastewater treatment operations. Also, as noted for Alternative 1, the volume of water entering the B-series ponds from TTF operations would be insignificant relative to the South Walnut Creek baseline flow, surface water runoff, and the WWTP baseline effluent level.

It is not expected that significant changes to the operations protocol identified in the POP/BOP would be required to support Alternative 3. However, the POP/BOP should be revised enough to allow for higher flowrates as part of controlled detention operations during periods when higher flowrates are desirable. It should also be noted that with the standard of 15 pCi/liter for both plutonium and americium, there is the possibility that the elements of the POP/BOP addressing maintenance of Plutonium and Americium standards compliance may be unnecessary given that the sources of Plutonium and Americium (WWTP effluent and surface water runoff from the Site) may never approach 15 pCi/liter. It may be a simple exercise to demonstrate that effluent from the WWTP is significantly below the 15 pCi/liter plutonium and americium standards and that runoff alone would not lead to plutonium and americium concentrations in the ponds in excess of 15 pCi/liter (historical activity levels associated with Site runoff in the ponds is addressed in the POP/BOP). Such a demonstration may enable pond operations to be simplified under Alternative 3.

Groundwater Management

Groundwater management would be the same under Alternative 3 as described for Alternative 1, with the exception that the increase in the uranium standard may preclude the need for its removal from groundwater that may be recovered by the ITS system.

Monitoring Programs

Monitoring under Alternative 2 would be as described for Alternative 1.

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Water Treatment

For this alternative temporary, modified, 10^{-4} risk-based goals of 15.0, 15.0, and 30.0 pCi/liter for plutonium, americium, and uranium, respectively, must be met. All process wastewater resulting form building operations, building deactivation, and decontamination and decommissioning that could potentially contain radionuclides would be treated in the TTF.

Influent wastewater to the TTF would be stored in tanks prior to being pumped to a chemical precipitation system. This system serves to change the form of dissolved species to a precipitated form that can then be removed by membrane filtration. The membrane filtration system traps suspended solids which are larger than the membrane pore size and returns them to a concentration tank. Slurry from the concentration tank would be sent to a sludge dewatering system, such as a filter press, to further concentrate the solids thereby minimizing the volume of secondary waste produced. Filtrate, with greatly reduced concentrations of plutonium and americium, would be neutralized and sent to a bone char polishing system specifically designed for plutonium reduction. Levels for plutonium, americium, and uranium should all be reduced to below the regulatory limits using this technology. Additional information about this alternative may be found in the *Technology Justification for the Temporary Treatment Facility (RTG, 1996).*

4.2.6 Development of Sub-Alternatives

Sub-alternatives for water management at the site have been evaluated based on different regulatory scenarios for non-radionuclides. The following sections discuss the impact of these different scenarios on the four water management elements in a general sense. Following this discussion, a summary of sub-alternatives to be considered is provided.

Surface Water Management

In terms of the secondary discriminators identified in Section 4.2.2, the only significant impact to surface water management would stem from differences in the nitrate/nitrite standards between the agricultural and the drinking water supply use classifications for the receiving stream. Specifically, because of the source of nitrate/nitrite in water collected with the ITS at OU4, there exists a potential that nitrate/nitrite standards in surface water could be exceeded. *The Basic Standards and Methodologies for Surface Water 3.1.0* (5 CCR 1002-8) identifies the agriculture standard for nitrate/nitrite as 100/10 mg/liter as Nitrogen, and the drinking water supply standard as 10/1 mg/liter as Nitrogen. The standards for the two use classifications differ by a factor of ten. Thus, the use classification designated for the receiving stream (Walnut Creek) may have an impact on treatment requirements for ITS water if that water continues to be collected.

As previously noted, management of surface water discharges from the ponds is primarily driven by radionuclide standards rather than standards for other pollutants. Given that treatment systems will be implemented for both process water (i.e. the TTF) and groundwater such that surface water is protected, differences in standards for non-radionuclides would not have any direct impact on basic pond operations.

Groundwater Management

In terms of the secondary discriminators identified in Section 4.2.2, there exists the potential for differences in approaches to groundwater management, depending on the use classification designated for surface water receiving groundwater via seeps and specified points of compliance/evaluation. The goal of the Groundwater Strategic Plan to evaluate groundwater management needs based on MCLs is expected to satisfy requirements for protection of surface water. The use of MCLs may have to change, depending on points of compliance/evaluation established for the Site.

A change in the basics for groundwater treatment from MCLs to a stream use classification may result in additional groundwater requiring treatment. The existing

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Sitewide Treatment Facility (STF) is designed for this specific purpose. The STF incorporates the original OU1 and OU2 treatment systems into a single facility, and includes UV oxidation and activated carbon for organic compound removal and chemical precipitation, membrane microfiltration, and ion exchange for radionuclide and metals removal. Therefore, while use of stream classifications may impact the overall need for groundwater treatment, that need is addressed by the use of the STF.

Monitoring Programs

The secondary discriminators identified in Section 4.2.2 will have an impact on the type and quantity of monitoring required. The monitoring plan for each alternative would have to be adjusted to take into account the individual contaminants identified in the standards for the various use classifications. Given the overall complexity and depth of monitoring programs at the Site, the incremental impact on monitoring requirements due to different stream use classification scenarios would not be expected to be significant.

Water Treatment

In terms of the secondary discriminators identified in Section 4.2.2, the only significant impact to water treatment would stem from differences in the nitrate/nitrite standards between the agricultural and the drinking water supply use classifications for the receiving stream. If the drinking water or agricultural use classification is imposed then the wastewater stream will require additional processing to reduce nitrate to the required levels due to the high level of nitrate/nitrite in water collected with the ITS at OU4. The technology of choice to reduce nitrate is biological denitrification. This process would be a batch process carried out in the existing modular storage tanks T-308B&C. Methanol would be added as a source of carbon and would also serve as an oxygen scavenger. The contents of the tank would be circulated through a heat exchanger to maintain the required temperature of 60° to 70°F. As the nitrate level in the tank is reduced to an acceptable level, a portion of

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the recirculating stream would be diverted through a clarifier for biomass removal. The resulting biomass would be transferred to a sludge tank/digester prior to being loaded into a vacuum tanker for transfer to the Waste Water Treatment Plant. The clarified water from the tank would normally be discharged directly into Walnut Creek. During periods of very wet weather, however, it may be possible that there would be insufficient time to allow for a tank to be treated to discharge levels before it would have to be emptied to make room for the next batch. Therefore, a standby ion exchange system using nitrate-selective ion exchange resin would be available. Additional information about this alternative may be found in the *Conceptual Design Report for the ITS Water Treatment Facility (RMRS, 1996).*

Summary of Alternatives

The preceding sections have identified that the secondary discriminators of stream use classification do not affect the elements of surface water or groundwater management, or monitoring programs, regardless of the radionuclide standards or goals assumed to be applicable. However, treatment requirements may vary due to the need to treat water collected from OU4 via the ITS. As noted, this water will require treatment for both uranium and nitrate/nitrite removal. Regardless of the stream use classification, this stream may require treatment for uranium removal. Under two of the three use classifications, treatment for nitrate/nitrite removal may also be necessary.

For the purposes of this study, the potential need of ITS treatment is common to all three primary water management alternatives. Therefore, the impacts, both technically and economically, are similar to all three primary alternatives. Therefore, this Sub-alternative will be developed as a stand-alone option to any of the other alternatives.

4.3 EVALUATION OF ALTERNATIVES

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Appendix A

Supporting Calculations for IWMS

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